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Developmental and histochemical studies on antheridium formation and spermatozoid release in *Turbinaria conoides* (Phaeophyta)

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The receptacles in *Turbinaria conoides* (Fucales, Sargassaceae) are bisexual with the antheridia generally occurring at the upper end of the conceptacle. Antheridia are either sessile or stalked and the number of stalk cells varies from one to three. The young antheridium (uni/binucleate stage) has one wall layer whereas those with eight or more nuclei have two. Critical staining shows that wall layers contain alginic acid and sulphated polysaccharides. In mature antheridia the inner wall layer has a greater deposition of sulphated polysaccharides than the outer. The lumen between the two wall layers is filled with sulphated polysaccharides. As the antheridia mature two zones of polysaccharides and a change in the metachromasy of its cytoplasm can be recognised. At the time of spermatozoid release the cytoplasmic zonation degenerates. The outer wall layer lyses at or near the apex of the antheridium and the spermatozoids are discharged enclosed in sulphated polysaccharides.

Key Index Words: alginic acid—cytoplasmic zonation—metachromasy—sulphated polysaccharides—spermatozoids.

The mature antheridium in the Fucales has two wall layers (FRITSCH 1945). On the basis of histochemical reactions, however, MCCULLY (1968) suggested that *Fucus distichus* subsp. *edentatus* (PYL.) POWELL has four wall layers. LEVRING (1952) discussed metachromasy in the antheridial wall of *Ascophyllum nodosum* (L.) LE JOL. and *Fucus serratus* L. but did not elucidate the number of wall layers.

In the Fucaceae the male cells enclosed by the inner wall layer are extruded as oblong packets embedded in mucilage through the ostiole (FRITSCH 1945), but the mechanism of spermatozoid release is not entirely clear. In *Laminaria* spermatozoid release is mediated by a pheromone that causes the rupture of antheridial wall. The mucilage in which the spermatozoids are enclosed at the time of release consists of fucoidin (MAIER 1982). The present study of *Turbinaria conoides* (J. AG.) KÜTZ. was undertaken to examine the nature of materials associated with antheridial wall layers and their role in spermatozoid release.

Material and methods

Turbinaria conoides was collected from Port Okha at low tide periods during the months of December 1981, October 1982, December 1982, June 1983, and September 1983. Port Okha is situated 22°28′N, 69°05′E on north Gujarat (India) coast and is bordered by the Arabian Sea. Receptacles at progressive developmental stages were fixed in 10% acrolein and post-fixed in 1% mercuric chloride to stabilize polyphenols. Dehydration, infiltration and embedding were carried out according to FEDER and O'BRIEN (1968). Sections of 2 μm thickness were cut using glass knives on a Spencer AO rotary microtome with locally-designed adaptor. The plastic sections were either stained with 0.05% toluidine blue O (TBO) prepared in benzoate buffer at pH 4.4 (MCCULLY 1966) or by periodic acid Schiff's reagent, PAS, (FEDER and O'BRIEN 1968). Aldehyde groups introduced by acrolein fixation were blocked before PAS reaction by treating the slides with chlorous acid (RAPPAY and VAN DUIJN 1965) or with 0.5% aqueous dimedone. The slides were also stained with 0.5% Alcian blue at pH 0.5 for sulphated polysaccharides (PARKER and DIBOLL 1966), and coomassie brilliant blue method for proteins (WEBER and OSBORN 1975). Controls were performed to check the specificity of various histochemical reactions.

Results

Morphology

Turbinaria conoides is a compact, radially organised cone-like plant. The thalli are firmly attached to the substratum by means of attaching discs and the spreading branches of haptera. The main axis is upright, cylindrical and densely covered by leaves (Fig. 1A). The receptacles are branched (Fig. 1B) and axillary. Both antheridia and oogonia are borne on the same conceptacles (Fig. 1C). Spermatozoids are shed en masse whereas the oogonia are attached to the inside of the conceptacle by mesochiton stalks.

Developmental studies

The antheridial mother cell is distinguished by dense cytoplasm and a prominent nucleus. Uninucleate (Fig. 1D) and binucleate antheridia possess only a single wall layer. Antheridia with four nuclei could not be observed but those with eight nuclei show two distinct wall layers. The nuclei in such antheridia are small, round and possess chromocentres. The initial nuclear division in the antheridium is meiotic and subsequent divisions are mitotic giving rise to 64 spermatozoids.

Antheridia are either stalked or sessile and when stalked the number of stalk cells varies from 1-3 (Fig. 1E). Sessile antheridia are formed directly on the germinal epithelium. Mature antheridia have two wall layers and the lumen is filled with polysaccharide materials (Fig. 1E–H). In the stalk cell the longitudinal wall is thicker than the tangential wall. The former shows two layers whereas the latter has only single layer. The stalk cell contains a small nucleus, phenolic bodies, a few polysaccharide granules and chromatophores. As the antheridium matures, its cytoplasm gradually becomes granular and shows two zones, the outer containing free granules and the inner aggregates (Fig. 1I). Spermatozoids remain in the inner zone. A few antheridia show linearly-arranged granules (Fig. 2B). In some antheridia the spermatozoids are sequestered by thin walls and each compartment contains a nucleus along with a portion of cytoplasm (Fig. 2C).

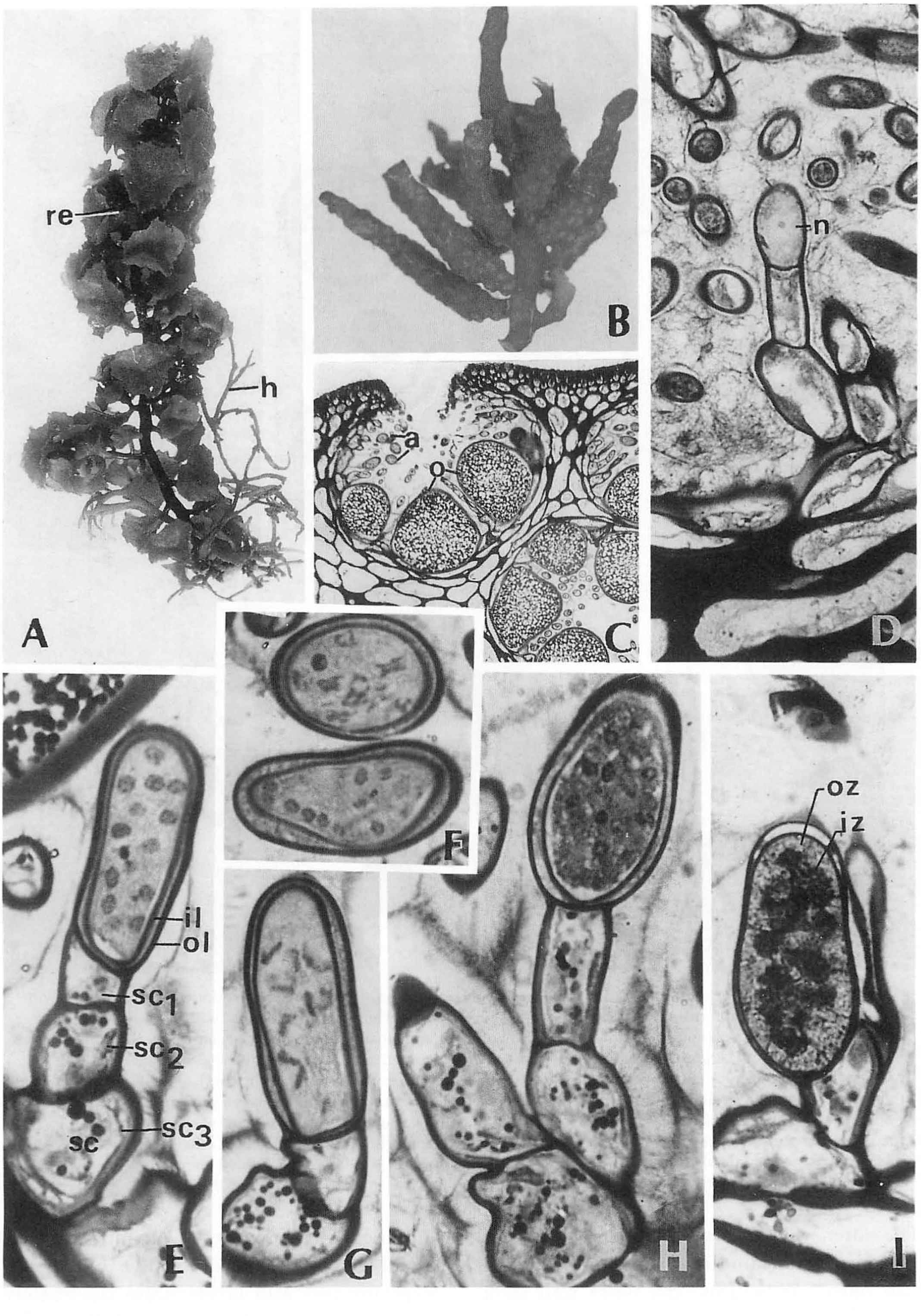
Antheridial release

In an antheridium ready for release the space narrows between the two wall layers, except in the upper region (Fig. 2D). The inner wall layer extends at the proximal end forming a small stalk (Fig. 2E). The spermatozoids enclosed in the polysaccharide material are released in a mass (Fig. 2F) and are gradually pushed through the ostiole.

Histochemical studies

Insoluble polysaccharides: In uninucleate and binucleate antheridia the wall layers stain reddish-violet with TBO and moderate magenta with PAS. In antheridia with eight nuclei the wall is two-layered and each wall layer shows different staining intensities.

Fig. 1A–I. *Turbinaria conoides*. A. Reproductive thallus, at the base of axis are spreading branches of haptera (h) that anchor the plant to the substratum. The receptacles (re) are borne in the axil of the leaves. × 1.5. B. A branched receptacle. × 5.3. C. A portion of mature receptacle to show oogonia (o), antheridia (a) and paraphyses. × 115. D. Magnified view of a young antheridium surrounded by single wall. A large nucleus (n) is present. × 1100. E. Mature antheridium with the two wall layers, the outer wall layer (ol) and inner wall layer (il). The lumen between the two wall layers contains polysaccharide material. Three stalk cells (sc 1–3) are also present. × 1100. F and G. Antheridia at different divisional stages. × 1100. H. A mature antheridium enlarged to show granular polysaccharide in the cytoplasm. × 1100. I. Same, showing two zones of polysaccharides in the cytoplasm. The outer zone (oz) consists of aggregated and intensely stained granules. × 1100.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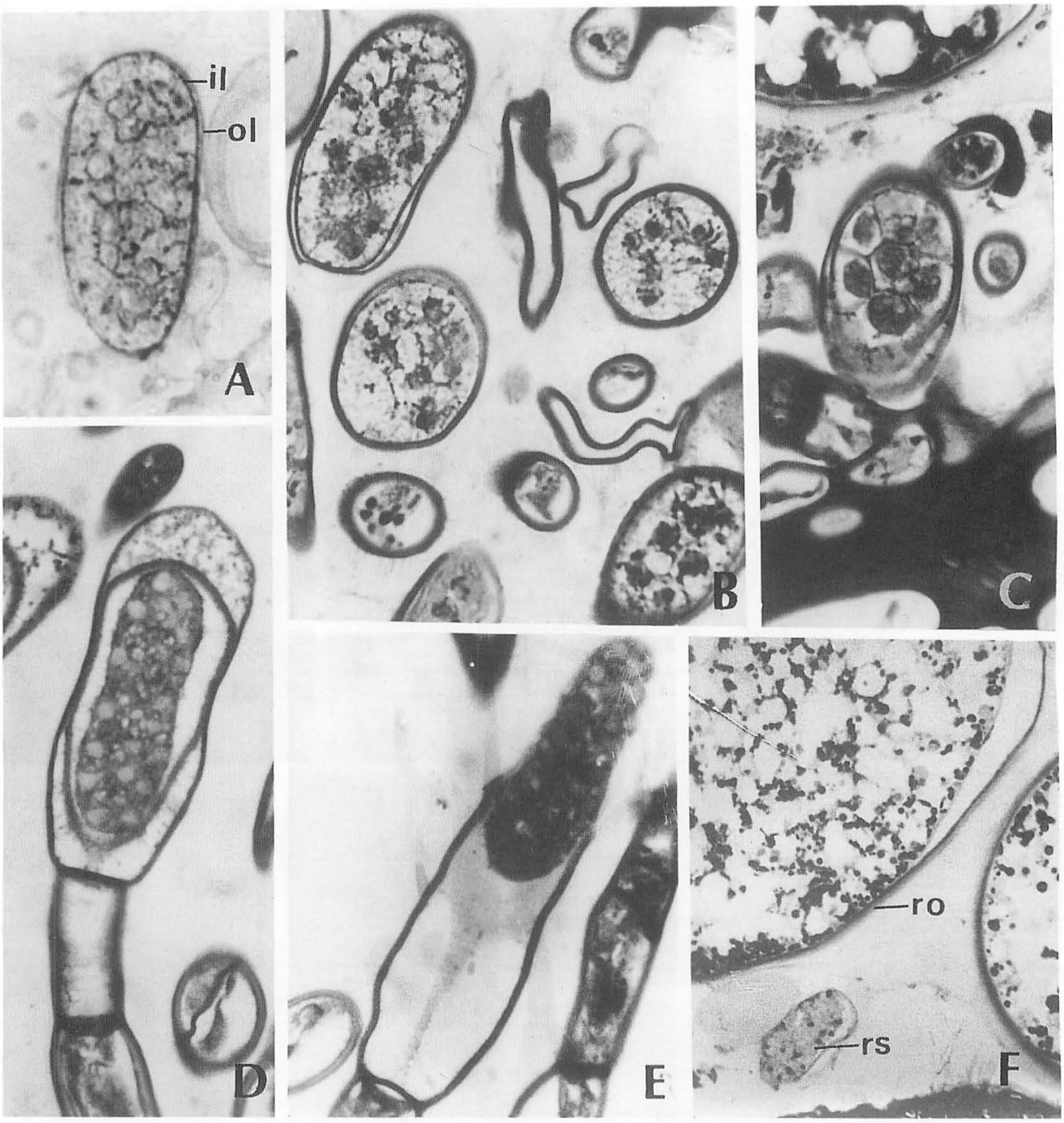

Fig. 2A–F. *Turbinaria conoides*, localization of polysaccharides. A, stained with Alcian blue and B–F, with TBO. A. Mature antheridium to reveal more sulphated polysaccharides in the inner wall layer (il) than in the outer layer (ol). The cytoplasm contains a mixture of large and small granular polysaccharides. The former are intensely stained and aggregated whereas the latter lightly stained and dispersed in the cytoplasm. ×1000. B. Mature antheridia enlarged to show linearly arranged polysaccharide granules (arrows). ×1000. C. An antheridium magnified to show thin partition walls (arrow). Each compartment encloses a nucleus along with a portion of the cytoplasm. ×1100. D and E. Antheridia magnified showing *en masse* release of spermatozoids. In D, the space between the two walls has decreased except at the apical and lower end. In E, the outer wall layer (ol) has ruptured at the apical end for the release of the spermatozoid. ×1400. F. Released oogonium (ro) and spermatozoids (rs). The spermatozoids are ensheathed in the polysaccharide matrix. ×426.

The outer wall layer stains intensely whereas the inner layer stains lightly with PAS and Alcian blue. With TBO the outer wall layer stains reddish-violet whereas the inner layer stains red. The two wall layers are therefore composed of a mixture of alginic acid and sulphated polysaccharides. The lumen between the two wall layers stains moderately with Alcian blue, light pink with TBO, and is PAS-negative. The lumen thus contains sulphated polysaccharides. At the antheridium stalk cell junction the wall exhibits intense staining with TBO, PAS and Alcian blue indicating presence of mixture of alginic acid and sulphated polysaccharides. Cytoplasm in the young antheridium stains turquoise with TBO. As the antheridium matures there is a progressive change of

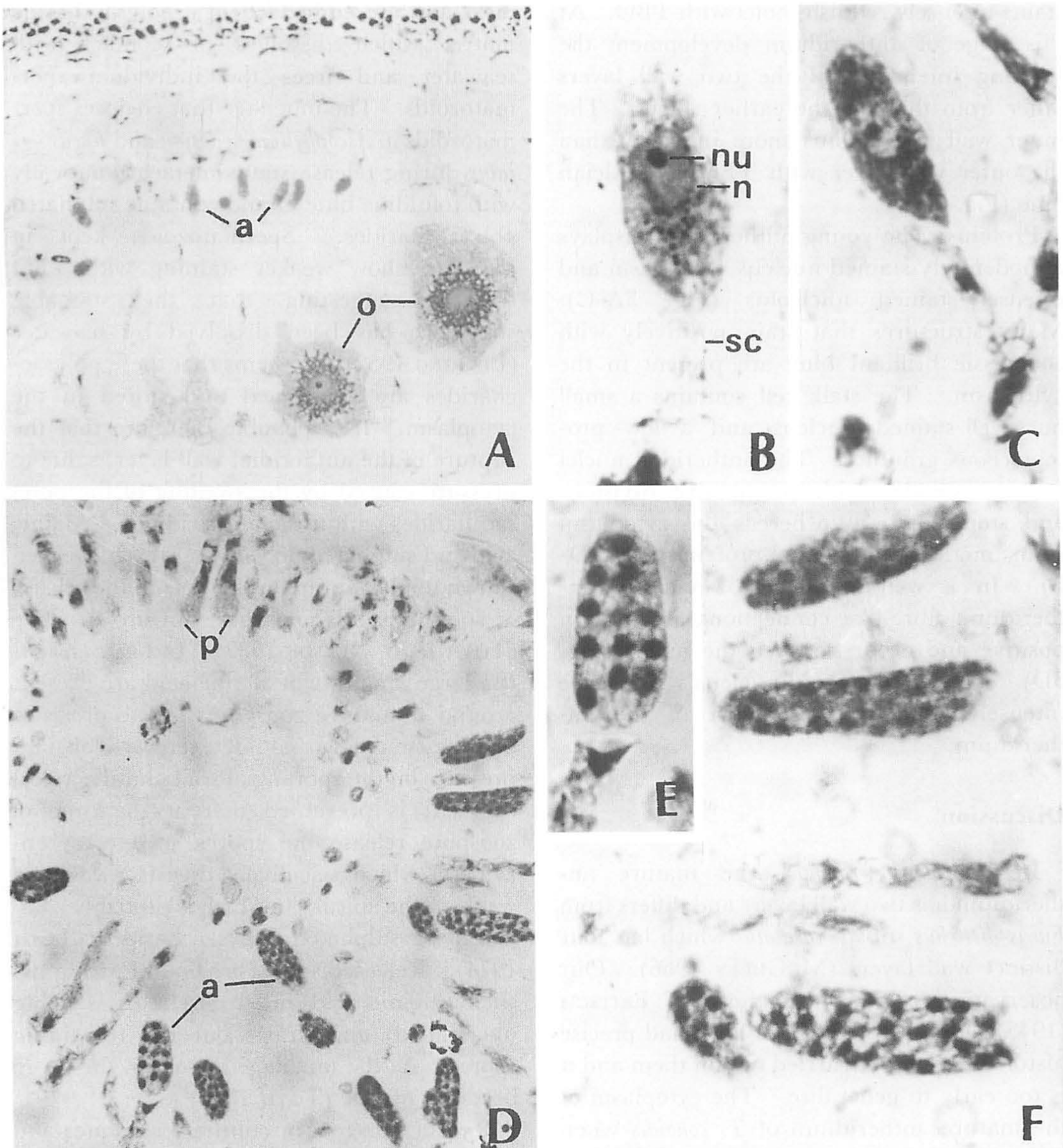

Fig. 3A–F. *Turbinaria conoides*, localization of proteins. A. A portion of transverse section of the conceptacle to show antheridia (a) present at the upper end and the oogonia (o) at the lower portion. × 115. B. A young antheridium enlarged to show a large nucleus (n) and intensely stained nucleolus (nu). Many coomassie brilliant blue positive structures are also present. × 1100. C. An antheridium at later stage of development showing well-defined cytoplasm and chromonemata in the nucleus. × 1100. D. A portion of conceptacle magnified to show paraphysis (p) and antheridia (a) at progressive stages of development. × 115. E. Mature antheridium showing the nuclei that are interconnected by thin and fibre-like structures. × 1100. F. Antheridia at 32-nucleate stage. The size of the nucleus has decreased. The fibre-like structures that interconnect the nuclei are well developed. × 1100.

metachromasy of its cytoplasm which stains reddish-violet with TBO. In the mature antheridium, the outer zone of free and granular polysaccharide stains lightly reddish-violet whereas the inner zone of aggregate granules stains intensely reddish-violet with TBO. At this stage of antheridium development the staining intensities of the two wall layers differ from those of the earlier stages. The inner wall layer stains more intensely than the outer wall layer with TBO and Alcian blue (Fig. 2A).

Proteins: The young antheridium displays a moderately-stained nucleus, cytoplasm and intensely-stained nucleolus (Fig. 3A–C). Many structures that stain positively with coomassie brilliant blue are present in the cytoplasm. The stalk cell contains a small but well-stained nucleus and a few proteinaceous granules. The antheridial nuclei become smaller with progressive divisions and stain intensely whereas the cytoplasm stains moderately for total proteins (Fig. 3D–F). In a well-developed 32-nucleate antheridium fibre-like connections are protein positive and occur between the nuclei (Fig. 3D). The spermatozoid nucleus stains more intensely than the cytoplasm of the antheridium.

Discussion

In *Turbinaria conoides* the mature antheridium has two wall layers and differs from *Fucus distichus* subsp. *edentatus* which has four distinct wall layers (MCCULLY 1966). Our observations agree with those of FRITSCH (1945). So far few Fucales have had precise histological studies carried out on them and it is too early to generalise. The cytoplasm of the mature antheridium of *T. conoides* when stained with TBO and Alcian blue shows two kinds of polysaccharide granules: (1) the lightly stained dispersed granules and (2) the intensely stained aggregated granules. BIDWELL *et al.* (1968) reported two kinds of fucoidin in *Fucus vesiculosus* L.: (1) a readily hydrolysed and water soluble component that may serve as a reserve and (2) an insoluble component that acts as an important structural component of the plant. We think that the polysaccharides in the cytoplasm of mature antheridia of *T. conoides* may act as reserve. The spermatozoids are released as a mass and are embedded in a polysaccharide matrix which dissolves on contact with seawater and frees the individual spermatozoids. The mucilage that encloses spermatozoids in *Ascophyllum nodosum* and *Fucus serratus* during release stains metachromatically with toluidine blue O and contains sulphated polysaccharides. Spermatozoids kept in seawater show weaker staining with TBO thereby suggesting that the stainable substance has been dissolved by seawater (LEVRING 1952). It seems that these polysaccharides are preformed and stored in the cytoplasm. It is possible therefore that the rupture of the antheridial wall layer is due to pressure caused by the swelling of the polysaccharides within the antheridium. Alginic acid and sulphated polysaccharides have been shown to play an important role in the release of spermatozoids and spores of brown algae (TOTH 1976, NELSON 1982). In *Chorda tomentosa* large amounts of alginic acid are present around immature zoospores. The presence of this mucilage could exert a constant pressure on the sporangial wall and the apical cap. It is presumed that at the time of zoospore release the spores secrete an enzyme(s) which selectively digests away and weakens the apical cap which is probably composed of sulphated polysaccharides (TOTH 1974). Released spores are bound within the sticky alginic acid and it swells (now being unconfined) and draws out the remaining spores. As the mucilage dissolves, the spore becomes mobile (TOTH 1976).

Recent progress in culture techniques and analytical chemistry revealed that in the members of Laminariales, particularly *Macrocystis, Laminaria* and *Chorda*, a volatile compound of low molecular weight secreted from released eggs induces spermatozoid release. The substance was named as lamoxirene (MAIER 1982, MÜLLER *et al.* 1985). In *Laminaria digitata* (L.) LAMOUR., the antheridia show a specialized swelling of the cell wall. In the apical region of the antheridium the cell wall is markedly thickened to form a "cap" (MAIER and MÜLLER 1982, MAIER 1987). The spermatozoids are surrounded by copious mucilage and both factors contribute to an explosive bursting of antheridium (MAIER and MÜLLER 1982).

During dehiscence the wall in this region is disintegrated to such an extent that the spermatozoids can rupture it within about 0.3 sec and it forces out antheridium apparently driven by an internal pressure which perhaps is generated by swelling of mucilage (MAIER 1987). In *Scytosiphon* both male and female gametes are released by dissolution of the gametangial wall (CLAYTON 1984). In *T. conoides* the spermatozoids are pushed up gradually by the inner wall layer into the conceptacle cavity and later discharged into the seawater. The manner in which the spermatozoid mass passes from the conceptacle cavity to the external seawater is intriguing and needs further investigations. MANTON and CLARKE (1956) suggested that in *Fucus* sp. the spermatozoids are only released after the mucilage in the conceptacle is extruded and dissolved.

Oogonial release in *T. conoides* appears to be entirely different (SOKHI and VIJAYARAGHAVAN 1986). The released oogonium lies outside the ostiole but remains attached to the exochiton within the conceptacle by means of mesochiton stalk. Prior to release oogonium shows reverse polarity. At the distal end of the oogonium a mesochiton pad remains attached to the exochiton and proximal end is first to be extruded. No such inversion occurs in the antheridium as the small and transistory stalk formed by the inner wall layer in the proximal end pushes the polysaccharide-surrounded spermatozoids. The inner wall layer of the antheridium in *T. conoides* thus performs a dual role: it aids in release and also in the protection of the released spermatozoids.

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SOKHI, G.・VIJAYARAGHAVAN, M. R.：褐藻 *Turbinaria conoides* の造精器形成と精子放出に関する発生学的ならびに組織化学的研究

ラッパモク属の一種 *Turbinaria conoides*（ヒバマタ目ホンダワラ科）の生殖器床は両性で，造精器は通常生殖器巣の上端に形成される。造精器は無柄または有柄で，柄細胞の数は1～3である。若い造精器（1～2核期）は1層の細胞壁をもつが，8核以上の段階になると2層の細胞壁をもつ。染色法により，細胞壁はアルギン酸と硫酸多糖類を含むことを明らかにした。成熟した造精器では，細胞壁の内層は外層より硫酸多糖類の沈着が著しい。内層と外層の間の内腔は硫酸多糖類で満たされている。造精器が成熟するにつれ，2層の多糖類と細胞質のメタクロマジーの変化が認められるようになる。精子の放出時には，細胞質の成層は退化する。外層は造精器の先端またはその近くで分解し，精子は硫酸多糖類に包まれた状態で放出される。(Department of Botany, University of Delhi, Delhi-110007, India)

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The life history and evidence of the macroscopic male gametophyte in *Palmaria palmata* (Rhodophyta) from Muroran, Hokkaido, Japan

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DESHMUKHE, G. V. and TATEWAKI, M. The life history and evidence of the macroscopic male gametophyte in *Palmaria palmata* (Rhodophyta) from Muroran, Hokkaido, Japan. Jpn. J. Phycol. 38: 215–221.

Palmaria palmata was grown in cultures from spores and studied for cytology of fertilization process, life history and male gametophytic development. Tetraspores developed into female and male gametophytes in 1 : 1 segregation in cultures. The female gametophytes (discs) became mature by producing carpogonia with trichogynes even at 10〜12 celled stage in 4〜5-day-old culture. When the spermatia from locally collected plants were added to the female culture, they were readily attached to the trichogyne, the male nucleus entered into the trichogyne and fused with the carpogonium nucleus. The fertilized carpogonium formed a diploid erect thallus which consequently formed tetraspores in 6〜7-month-old culture. The male gametophytes grew vegetatively and formed haploid erect thalli, on which the spermatia were formed in 3〜4-month-old culture. Meiosis was observed in tetrasporangial first division. Morphological observations of macroscopic and microscopic plants of *P. palmata* from Muroran revealed some resemblances with *P. mollis* (S. & G.) VAN DER MEER and BIRD.

*Key Index Words: female gametophyte—fertilization—life history—male gametophyte—*Palmaria palmata*—Rhodophyta.*

The life history of *Palmaria palmata* (L.) KUNTZE has been studied by several workers (VAN DER MEER 1976, VAN DER MEER and CHEN 1979, VAN DER MEER and TODD 1980). YABU (1971, 1976) gave the cytological account on the chromosome numbers in this species (as *Rhodymenia palmata*). YABU and YASUI (1984), describing male gametophytic structure in the material (as *P. palmata*) from Hakodate, suggested that the male gametophyte also occurred in a microscopic form. However, the detailed cytological study of the fertilization process in *P. palmata* has not been done. In the present study we emphasized on the morphology and anatomy of male and female gametophytes and cytology of fertilization process. Also the diploid and haploid stages in the life history of *P. palmata* were confirmed. These results were similar to those demonstrated by VAN DER MEER and TODD (1980).

Elevation of *P. mollis* (S. & G.) VAN DER MEER and BIRD as an individual species from *P. palmata* f. *mollis* (S. & G.) GUIRY from the North Pacific Ocean and the comparison between these two species by VAN DER MEER and BIRD (1985) prompted us to reexamine the *P. palmata* from Muroran. *Palmaria* species collected along Muroran coast was so far referred as *P. palmata* (TAZAWA 1975, LEE 1978). In our observations, we found that this species showed more resemblance with *P. mollis* than with *P. palmata* from the North Atlantic Ocean.

Materials and Methods

Mature tetrasporophytes of *P. palmata* were collected from Muroran, Hokkaido. Tetraspores were cultured unialgally in PES medium (PROVASOLI 1966) at 10°C, and both $14:\overline{10}$ and $10:\overline{14}$ LD conditions under

55 μmol m^{-2} s^{-1} from cool-white fluorescent tubes. After the male and female gametophytes were differentiated from each other clearly (the female gametophyte is characterized by trichogynes), they were cultured separately. The spermatia obtained from locally collected mature male plants were inoculated on female gametophytes to observe fertilization process. For the cytological observations on fertilization and further developments, materials were fixed in 3 parts of 95% ethanol to 1 part of acetic acid for 2 hr and stained by aceto-iron-heamato-xylin method (WITTMANN 1965). To observe the fertilization process the slides were fixed at the intervals of 4, 6, 8, 10, 12 and 24 hr after the spermatium inoculation.

The anatomical details were compared with those given by GUIRY (1975), LEE (1978) and VAN DER MEER and BIRD (1985).

Results

Phenological and morphological observations

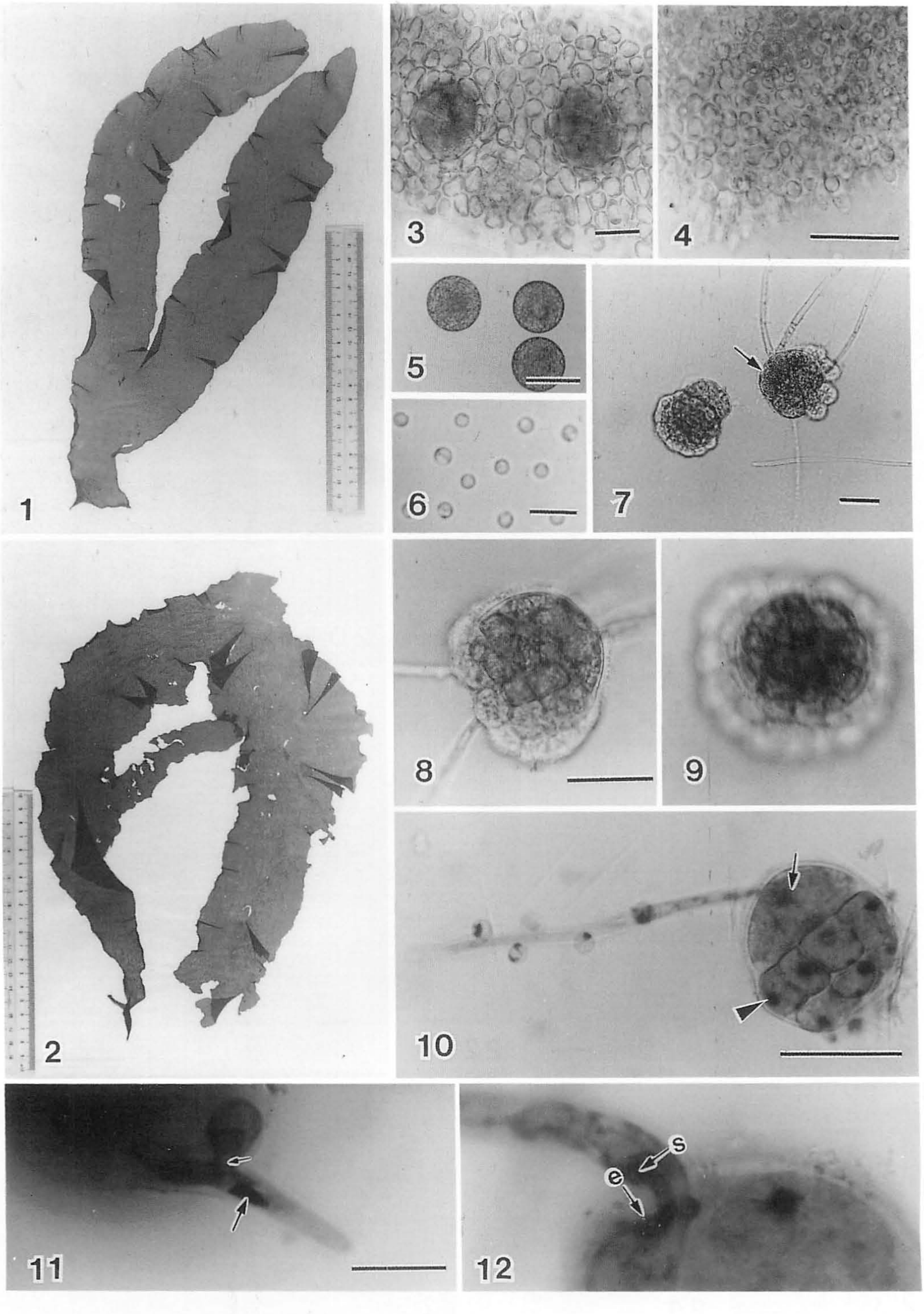
The mature thalli were found growing luxuriantly in number and size from December to May (upto 30-50~100 cm height) as described by LEE (1978). These thalli included both tetrasporophytes (Fig. 1) and spermatial thalli (Fig. 2), while some were sterile. The tetrasporic plants were large in number. The spermatial plants were also found frequently although a little less than tetrasporophytes.

The tetrasporic plants are easily distinguished by dark red in color from the pale colored spermatangial plants. The cortical cell size varied between 8-16 μm in diameter and the medullary cell size at the base of frond varied 130-410 μm in diameter. The arrangement of tetrasporangia confined to the outer cortical layer was found similar as showed by LEE (1978). The mature tetrasporangium was elliptical in transverse view and its size was 50-60 μm in length and 40-54 μm in width (Fig. 3). The mature spermatangia were oblong with size 8.6-11.2 μm in length and 3.4-4.8 μm in width (Fig. 4). The tetraspores were dark red in color and measured 15-20 μm in diameter, while the spermatia were light in color and 4.8-6.0 μm in diameter (Figs. 5, 6).

Culture experiments

The tetraspores germinated to form male and female gametophytes in 1 : 1 segregation (Fig. 7). Initial development of both the gametophytes was similar in form of prostrate disc. Within 4-day incubation, one cell of the female disc enlarged to form a carpogonium cell and a trichogyne emerged from the same cell. Sometimes more than one trichogyne emerging from the periphery were observed on the same disc (Figs. 7, 8). These carpogonium cells (eggs) were larger in size than the other disc cells and their nuclei were diffused, in contrast to the condensed vegetative cell nuclei. The female disc matured even at 10~12 celled stage (Fig. 10). Generally the disc of 100-125 μm size bears 18~50 trichogynes. These female discs, if not fertilized, grew into small erect

Fig. 1. Tetrasporophytic habit of *Palmaria palmata* from Muroran.
Fig. 2. *P. palmata* male gametophytic habit from Muroran.
Fig. 3. Surface view of tetrasporophytic thallus showing mature sporangia (scale = 30 μm).
Fig. 4. Surface view of male gametophyte showing superficially arranged spermatangia (scale = 30 μm).
Fig. 5. Released tetraspores (scale = 20 μm). Fig. 6. Released spermatia (scale = 15 μm).
Fig. 7. One: one segregation of male and female gametophytes after tetraspore germination in 4-day-old-culture (female is shown by arrow; scale = 100 μm).
Fig. 8. Mature female gametophyte with 3 trichogynes (4-day-old) (scale = 100 μm).
Fig. 9. Young male gametophyte with prostrate disc and centrally protruding erect thallus (scale = 100 μm).
Fig. 10. Female gametophyte with an enlarged carpogonium having diffused nucleus (arrow) and vegetative cells with condensed nuclei (arrowhead). Five spermatia are seen attached to a single trichogyne (scale = 30 μm).
Figs. 11, 12. Process of karyogamy (scale = 10 μm). Fig. 11 showing migration of spermatium nucleus (large arrow) in the trichogyne after dissolving the trichogyne wall (small arrow). Fig. 12. Fusion between the spermatium and carpogonium nucleus takes place within 6-12 hr (s, spermatium nucleus; e, carpogonium nucleus).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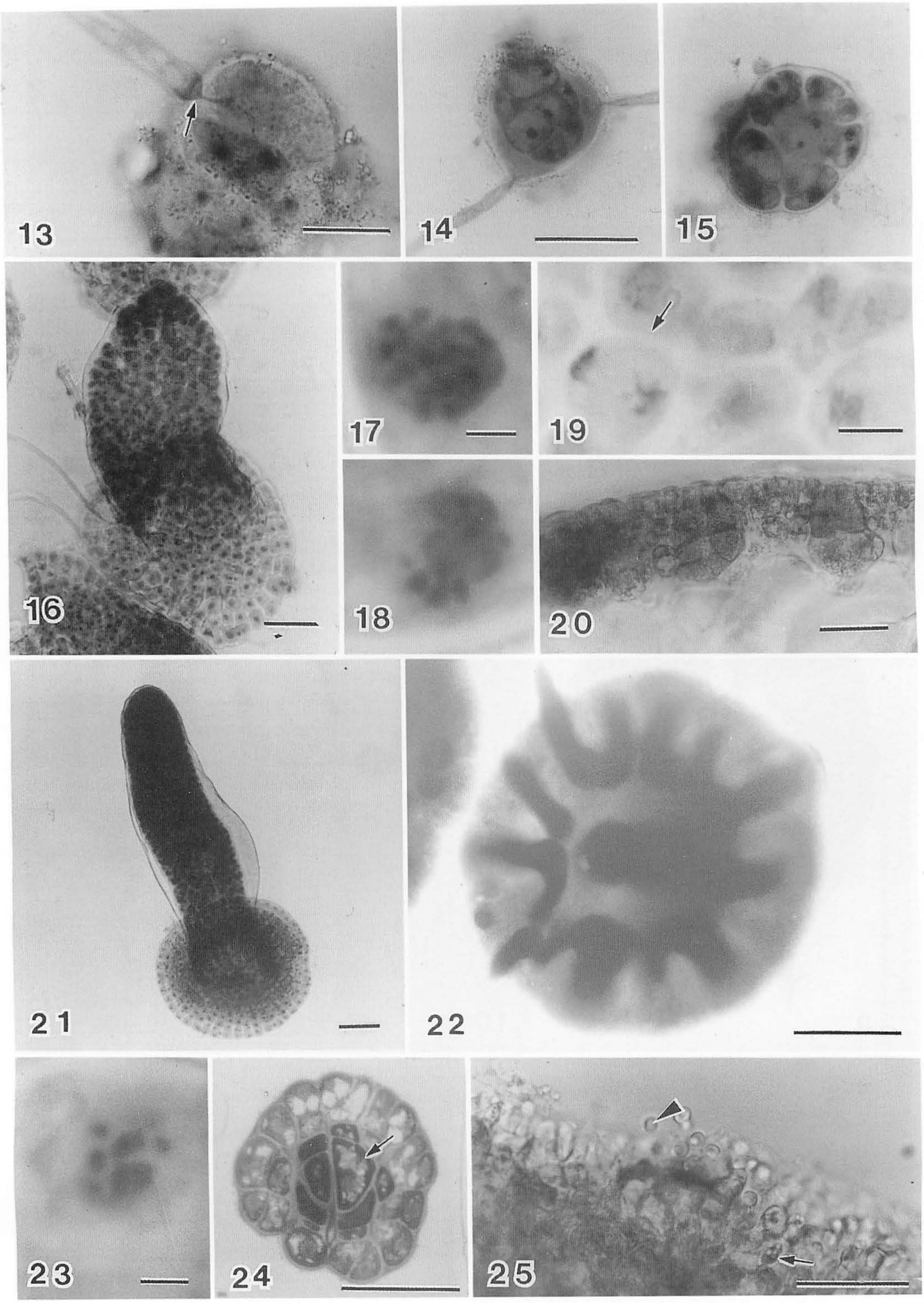
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thalli of 1 mm height with numerous long trichogynes and usually aborted in the culture dishes witin 2 months. The size of female disc varied from 100 to 500 μm in diameter.

Male discs showed a uniform growth and in 4～5-day-old incubation, their central cells divided obliquely to produce an erect thallus. The cells of erect thallus were easily distinguishable by dark red pigmentation (Fig. 9).

When adding the female cultures, the spermatia attached to the trichogyne within 4 hr. Attachment of more than one spermatium to a single trichogyne was quite a common feature (Fig. 10). After dissolving the trichogyne wall at the point of attachment, the spermatium nucleus migrated into the trichogyne and fused with the carpogonium nucleus (Figs. 11, 12). Once one spermatium nucleus fused with that of the carpogonium cell, the trichogyne of that cell became narrower forming a septum between itself and the carpogonium cell (Fig. 13). Thus the other spermatium nuclei which might have been entered in the same trichogyne could not enter in the carpogonium cell. The karyogamy took place within 6 to 12 hr. After fertilization, the carpogonium divided first transversely, and later vertically and obliquely, producing an erect thallus. No carpospore formation was observed. The erect frond developed directly on the female disc (Figs. 14-16). Growth of many erect thalli on a single female disc was due to one female disc bearing many carpogonia. These erect thalli were diploid where the disc still remained in haploid state. The diploid cells showed chromosome numbers 2n=40-42, and the haploid cells, n=20-21 (Figs. 16-18). Although the growth of these thalli was slower than the male plants, they developed into mature tetrasporic plants in 6～7-month-old culture (Figs. 19, 20).

The male gametophyte formed an erect thallus by protruding the central cells (Fig. 9). A 15～20-day-old erect thallus showed the uniform growth. Both the erect and disc cells were haploid (n=20-21) (Figs. 21, 23). In 1～2-month-old cultures, numerous male erect thalli showing the same chromosome numbers were observed growing radially on the same disc (Fig. 22). Figure 24 shows a cross section of young vegetative male disc. The light peripheral cells remained as the holdfast cells while the dark central cells dividing transversely and vertically formed the erect thallus. In 10°C and 14 : $\overline{10}$ LD culture condition the male plants matured within 3～4 months. In cross section (Fig. 25) the spermatangial mother cell was observed cutting off from the cortical cells. The spermatangial cluster was developed on these cells. The spermatangia were loosely arranged superficially on the cortex

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Fig. 13. After the karyogamy, trichogyne of that carpogonium cell becomes narrow to form a septum (arrow) between the carpogonium cell and itself (scale=20 μm).

Figs. 14, 15. Development of fertilized carpogonium cells (scale=30 μm). Fig. 14 showing 2 celled and Fig. 15 showing 4 celled stage.

Fig. 16. Fertilized diploid erect thallus on the haploid disc. The disc persists the trichogynes (15～20-day-old) (scale=30 μm).

Fig. 17. Diploid nucleus from the erect thallus. 2n=40-42 (scale=2 μm).

Fig. 18. Haploid nuclues of the disc cell. n=20-21 (scale=2 μm).

Fig. 19. Tetraspore formation 1st division (arrow) in the tetrasporangium mother cell in 7-month-old culture (scale=5 μm).

Fig. 20. Cross section of tetrasporic thallus showing development of tatrasporangia in cortical region (scale=30 μm).

Fig. 21. Haploid male erect thallus from 15～20-day-old culture (scale=30 μm).

Fig. 22. Radial growth of many male thalli on the same disc (scale=400 μm).

Fig. 23. Male gametophytic cell with the haploid nucleus. n=20-21 (scale=2 μm).

Fig. 24. Cross section of young male gametophyte (4～5-day-old culture) showing vegetative stage. The central cells with dark pigmentation form the erect thallus (arrow) and the peripheral cells with light pigmentation remain as disc cells (scale=30 μm).

Fig. 25. Cross section of mature male plant (3～4-month-old culture) showing development of spermatangia. The spermatangial mother cells (arrow) cutting off from cortical cells from loosely arranged spermatangia on the thallus surface (arrowhead) (scale=30 μm).

and had the same morphology of those of male gametphytes from nature.

Discussion

The development of male and female plants in culture, the process of fertilization and the development of erect thallus of *P. palmata* from Muroran, Japan, show a similar pattern described for the order Palmariales (VAN DER MEER 1976, VAN DER MEER and CHEN 1979, VAN DER MEER and TODD 1980, VAN DER MEER and BIRD 1985). The chromosome numbers were similar to those observed by VAN DER MEER and CHEN (1979). Although there are many reports on the life history of the order Palmariales, very few reports give the detail picture of the fertilization process. MITMAN and PHINNEY (1985) studied fertilization and development of zygote in *Halosaccion americanum* using SEM. YABU and YASUI (1984) observed the migration of spermatium in the trichogyne of *P. palmata*. Both studies show the attachment and entry of the spermatia in the trichogyne. However, the actual karyogamic process was not described by these workers. The direct development of diploid erect thallus on the female disc has been very well demonstrated by VAN DER MEER and TODD (1980) by using green female for crossing; the diploid erect thallus, red in color, grew directly on the green female disc. In our experiment, we used both wild types and confirmed the diploid phase by chromosome counts.

The collections for anatomical features of our *Palmaria* plants showed the same characteristics given by TAZAWA (1975) and LEE (1978). The development of spermatia on the spermatangial mother cell was distinct in collected as well as cultured male plants. This is a common character of Florideae (TAZAWA, 1975). YABU and YASUI (1984) demonstrated particular development of male gametophytes. In their culture study, they described 1～8 celled mature male discs in 4-day-old culture; namely, the cell contents of such germlings divided rapidly into numerous minute granules to form spermatia. Further YABU and YASUI (1984) related existence of these dwarf male plants with the rare occurrence of macrophytic male gametophytes at Hakodate. However, during the present investigations we could not observe this kind of male gamete formation. HAWKES and SCAGEL (1986), discussing the life histories in Palmariales, expressed doubts on the existence of such a dwarf male until confirmation.

In our culture experiments, we observed that the development of male plant was not a rare phenomenon. In fact the male erect thalli were numerous. At our collection site near the Institute of Algological Research, Muroran (42°19′N; 140°59′E), we observed a frequent growth of male thalli. Previous reporters TAZAWA (1975) and LEE (1978) also noted the frequent growth of male *P. palmata* in Muroran area. However, in *P. marginicrassa*, LEE (1978) reported the rare occurrence of male plants in the field. Despite numerous growth of male plants in culture, they occur comparatively less in numbers in the field than the tetrasporophytes. The ecological reason for this situation is not known. GUIRY (1975) suggested that the plants were possibly neglected while making the collections. Hence a detail phenological study can help to understand the distribution of male and tetrasporophytic plants in the field.

TAZAWA (1975) and LEE (1978) studied the *P. palmata* from Muroran and retained at the same species level. Although LEE's (1978) anatomical description was comparable with those given by GUIRY (1975), he did not give any comparative account. In our culture experiments we observed many carpogonia producing numerous trichogynes toward the periphery of the disc. This result is quite similar to those illustrated by VAN DER MEER and BIRD (1985) and HAWKES and SCAGEL (1986). Therefore, on the basis of our observations we propose that the present species *Palmaria palmata* from Muroran should be regarded as *Palmaria mollis* (S. & G.) VAN DER MEER and BIRD. Also in this aspect specimens of *Palmaria* from other localities along Japan coasts should be reexamined.

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DESHMUKHE, G. V.・舘脇正和：北海道室蘭産紅藻ダルスの生活史及び大形雄性配偶体

室蘭産紅藻ダルスの四分胞子の発芽体は培養において，1：1の割合で雌性及び雄性配偶体に生長した。雌性配偶体は4～5日培養で受精毛を伴った造果器を形成する。フィールドで採取した雄性配偶体の不動精子を培養の雌性配偶体に加えて受精させると，造果器は直ちに複相の直立葉を形成し，6～7ヶ月培養で成葉になり四分胞子を形成した。一方，雄性配偶体は栄養生長を続け単相の直立葉を形成し，3～4ヶ月培養で不動精子を形成した。また，フィールド及び培養藻体の形態観察から，室蘭産ダルスは *Palmaria mollis* (S. & G.) VAN DER MEER & BIRD との類似性が示された。（051 北海道室蘭市母恋南町1-13　北海道大学理学部附属海藻研究施設）

Material and methods

Samples of mature *Ecklonia cava* sporophytes were collected from a depth of about 5 m in Nabeta Bay, Shimoda, on the Pacific coast of central Japan in August 1985. They were kept in an outdoor water tank before use. Bladelets with few attached organisms were selected and detached from the sample plants, and were transported to the laboratory. Discs of 3.6 cm^2 or rectangular samples of about 15 cm^2 were cut out from parts with or without zoosporangial sori of the bladelets (cf. Fig. 2). These discs and rectangular samples of bladelets were kept in running seawater overnight (for about 12 h) in the laboratory before measuring photosynthesis and respiration to avoid unreliable results due to cutting (SAKANISHI *et al.* 1988).

Differential gas-volumeters (YOKOHAMA and ICHIMURA 1969, YOKOHAMA *et al.* 1986) were used to measure photosynthesis and respiration. Vessels with a capacity of about 50 or 200 m*l* were used as reaction and compensation vessels of the gas-volumeter. For the measurements a blade sample was placed in the reaction vessel with 10 or 50 m*l* of filtered seawater in the former or the latter vessel. A slide projector (Elmo S-300) with an incandescent lamp (Kondo 100 V 300 W) was used as the light source. Light intensity was measured with a lux meter (Lichtmesstechnik) and a quantum meter (LI-COR LI-185B). Various light intensities were attained by using neutral density glass filters.

After the measurements, the blade samples were rinsed with freshwater, dried at 85°C for 24 h in an electric drying chamber and weighed with a chemical balance to obtain dry weight. The blade discs of 0.57 cm^2 for the quantitative analysis of chlorophyll *a* were cut out from portions close to those used for measurements of photosynthesis and respiration, and ground with 90% acetone in a mortar to extract photosynthetic pigments. Absorbances of the extract were measured at 630, 645, 663 and 750 nm with a Shimadzu UV-3000 recording spectrophotometer and the chlorophyll *a* concentration was calculated by the formula of SCOR-Unesco (1966).

Results

Figure 1 shows photosynthesis-light curves of *Ecklonia cava* bladelets with or without zoosporangial sori on an area basis, on a dry weight basis and on a chlorophyll *a* basis, which were determined from six measurements at 20°C. In each case, the photosynthetic rate increased almost linearly with increase in light intensity up to about 25 $\mu E\ m^{-2}s^{-1}$, and slowly increased with further increase in light intensity to reach the light saturation at about 200 $\mu E\ m^{-2}s^{-1}$. Photosynthetic rates of sorus portion were always lower than those of non-sorus portion. The light-saturated net photosynthetic rate was 24.5 $\mu l O_2\ cm^{-2}h^{-1}$ (0.95 $\mu l O_2$

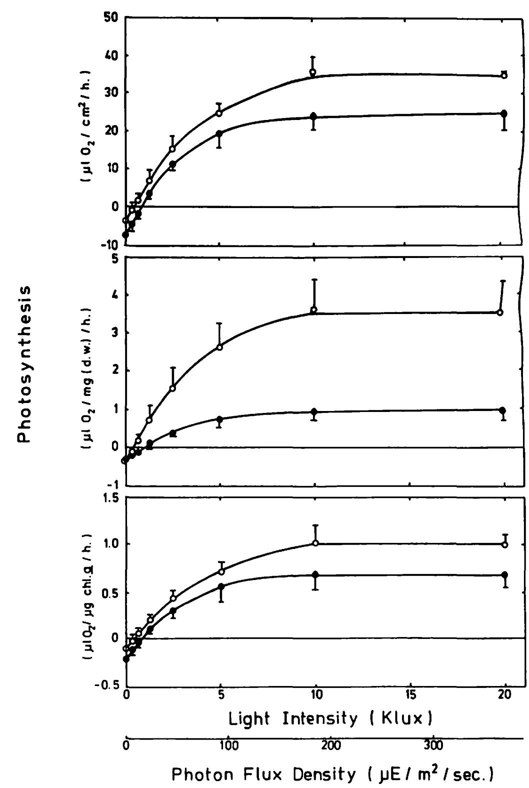

Fig. 1. Photosynthesis-light curves of sorus portion (solid circles) and non-sorus portion (open circles) of *Ecklonia cava* bladelets at 20°C. Mean with SD of 6 measurements.

Table 1. Comparison of dry weight per unit area (mg cm^{-2}) in sorus and non-sorus portions of *Ecklonia cava* bladelets used for measurements of photosynthesis and respiration.

Date	(a) Sorus portion	(b) Non-sorus portion	(a)/(b)
Aug. 17	26.5	15.4	1.7
18	25.8	8.6	3.0
25	29.2	7.4	3.9
26	27.3	10.2	2.8
29	21.9	9.8	2.2
30	24.7	10.7	2.3
Average	25.9	10.4	2.7
SD	2.5	2.6	0.8

$mg(d.w.)^{-1}h^{-1}$, 0.68 $\mu l O_2$ $\mu g(chl.a)^{-1}h^{-1}$) in sorus portion, whereas it was 35.0 $\mu l O_2$ $cm^{-2}h^{-1}$ (3.50 $\mu l O_2$ $mg(d.w.)^{-1}h^{-1}$, 1.00 $\mu l O_2$ $\mu g(chl.a)^{-1}h^{-1}$) in non-sorus portion. Photoinhibition of photosynthesis was not observed in the light intensity range employed (maximum 370 $\mu E\, m^{-2}s^{-1}$).

The rate of dark respiration was higher in sorus portion than in non-sorus portion both on an area basis and on a chlorophyll *a* basis, but was almost the same on a dry weight basis: 7.24 $\mu l O_2$ $cm^{-2}h^{-1}$, 0.28 $\mu l O_2$ mg $(d.w.)^{-1}h^{-1}$ and 0.21 $\mu l O_2$ $\mu g(chl.a)^{-1}h^{-1}$ in sorus portion; 3.45 $\mu l O_2$ $cm^{-2}h^{-1}$, 0.36 $\mu l O_2$ $mg(d.w.)^{-1}h^{-1}$ and 0.10 $\mu l O_2$ $\mu g(chl.a)^{-1}$ h^{-1} in non-sorus portion. The light compensation point was apparently higher in sorus

Table 2. Comparison of chlorophyll *a* content per unit area ($\mu g\ cm^{-2}$) in sorus and non-sorus portions of *Ecklonia cava* bladelets used for measurements of photosynthesis and respiration.

Date	(a) Sorus portion	(b) Non-sorus portion	(a)/(b)
Aug. 17	37.5	37.5	1.00
18	40.4	34.1	1.18
25	29.4	33.0	0.89
26	45.4	39.3	1.16
29	33.2	30.6	1.08
30	31.4	34.0	0.92
Average	36.2	34.8	1.04
SD	6.0	3.2	0.12

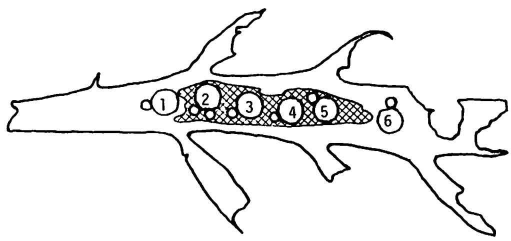

Fig. 2. Trace of an *Ecklonia cava* bladelet indicating the position of blade discs used for measurements of photosynthesis (Fig. 3), dry weight and chlorophyll (Table 3). The shaded part shows sorus portion.

portion than in non-sorus portion.

Dry weight per unit area was 25.9 mg(d.w.) cm^{-2}, in average, in sorus portion, while it was only 10.4 mg(d.w.) cm^{-2}, in average, in non-sorus portion of bladelets (Table 1). This indicates that sorus portion is thicker than non-sorus portion. Chlorophyll *a* content per unit area was not

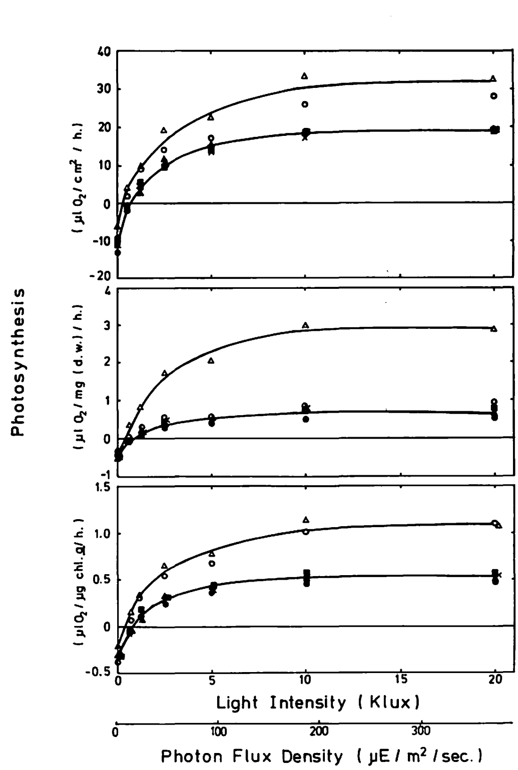

Fig. 3. Photosynthesis-light curves of various parts of an *Ecklonia cava* bladelet at 20°C. 1, open circle; 2, solid circle; 3, solid triangle; 4, solid square; 5, cross; 6, open triangle (cf. Fig. 2).

Table 3. Comparison of dry weight and chlorophyll *a* content per unit area in sorus and non-sorus portions of an *Ecklonia cava* bladelet on Ang. 11 (cf. Fig. 2) and Ang. 13 (cf. Fig. 4). Samples 1 and 6, non-sorus portion; samples 2–5, sorus portion (cf. Fig. 4).

Date	Dry weight (mg cm^{-2})						Chlorophyll *a* (μg cm^{-2})					
	1	2	3	4	5	6	1	2	3	4	5	6
Aug. 11	30.4	35.6	31.2	26.5	23.3	11.1	25.4	40.4	35.4	32.2	32.9	29.1
13	25.8	32.2	28.1	24.6	22.8	10.2	36.5	43.7	42.4	44.2	43.6	29.8

significantly different between sorus and non-sorus portions (Table 2).

Photosynthesis-light curves were compared with discs from various portions of an *E. cava* bladelet (Fig. 2). Figure 3 shows photosynthesis-light curves of 6 blade discs from the same bladelet including sorus and non-sorus portions. Blade discs from sorus portion had almost the same photosynthetic rates on an area basis, on a dry weight basis and on a chlorophyll *a* basis, irrespective of the position in a bladelet. The photosynthetic rate of blade discs from non-sorus portion was slightly higher at the apical part than at the basal part of a bladelet on an area basis, while on a dry weight basis it was clearly higher at the apical part than at the basal part.

As indicated in Table 3, dry weight per unit area was higher in the basal part than in the distal part within sorus portion, being also higher in sorus portion than in non-sorus portion near by; and in non-sorus portion it was considerably higher at the basal part than at the tip part of a bladelet (Figs. 2 and 4). Thus, the photosynthetic rate on a dry weight basis was apparently lower in the basal part without zoosporangial sori of a bladelet. Chlorophyll *a* content per unit area was significantly higher in sorus portion than in non-sorus portion (Table 3).

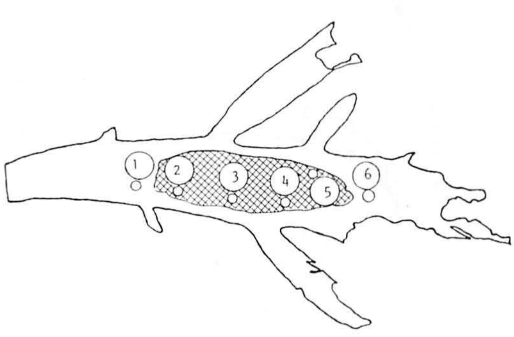

Fig. 4. Trace of an *Ecklonia cava* bladelet indicating the position of blade discs used for measurements of dry weight and chlorophyll *a* in Table 3.

Discussion

Sporophytes of *Ecklonia cava* in Nabeta Bay usually begin to form zoosporangial sori in their bladelets in July. Sorus portion of bladelets occupied 18.9% of the total dry weight of blades in August and 28.9% in September 1985 as illustrated in Fig. 5 which was compiled by the technique of MONSI and

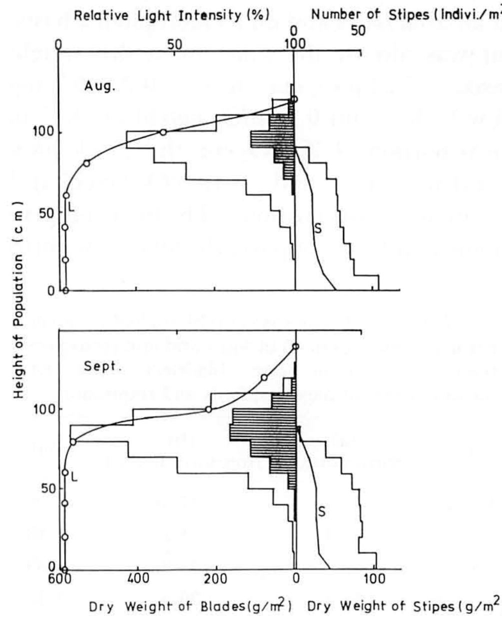

Fig. 5. Production structure diagrams of *Ecklonia cava* communities measured after the technique of MONSI and SAEKI (1953) in Nabeta Bay in August and September 1985. Shaded part indicates sorus portion. L, relative light intensity; S, number of stipes.

SAEKI (1953). In the present study, it is shown clearly that the photosynthetic rate was lower in sorus portion than in non-sorus portion of a bladelet either on an area basis, on a dry weight basis or on a chlorophyll *a* basis (Fig. 1). The light-saturated net photosynthetic rate of sorus portion was about 30% lower than that of non-sorus portion both on an area basis and on a chlorophyll *a* basis. The light-saturated net photosynthetic rate was about 72% lower in sorus portion than in non-sorus portion on a dry weight basis. This is mainly due to a great difference in dry weight per unit area between sorus portion and non-sorus portion, dry weight being 2.7 times as high in the former as in the latter (Table 1).

The rate of dark respiration was about twice as high in sorus portion as in non-sorus portion both on an area basis and on a chlorophyll *a* basis, whereas on a dry weight basis it was almost the same. It was shown that the light compensation point of sorus portion was about twice as high as that of non-sorus portion (Fig. 1). It is suggested that the bladelet becomes thicker when zoosporangial sori are formed in it, thus the light penetrating blade being attenuated more greatly to come to the assimilatory layer in thick sorus portion than in non-sorus portion. As it is expected that the respiratory rate is generally the same on a dry weight basis, thick sorus portion has higher respiratory rate on an area basis.

Although there was no significant difference in chlorophyll *a* content between sorus portion and non-sorus portion in the result shown in Table 2, the sample for Fig. 4 clearly indicated that chlorophyll *a* content per unit area was higher in sorus portion than in non-sorus portion (cf. Table 3) possibly due to additional chlorophyll *a* in sorus portion.

The rate of daily production of *E. cava* sporophytes in Nabeta Bay was reported to be highest in April-May and lowest in August-September (YOKOHAMA *et al.* 1987). The period of the lowest production corresponds to that of reproduction in *E. cava* sporophytes, sorus portion occupying about 30% of the total dry weight of blade as shown above. Sorus portions have higher compensation point and lower photosynthetic activity as compared with non-sorus portions as illustrated in Figs. 1 and 3. Thus, the lower photosynthetic rate of sorus portions is considered to be one of the causes for the lower rate of production in *E. cava* sporophytes in summer in Nabeta Bay.

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有賀祐勝[1]・豊島麻理[2]・横浜康継[3]：褐藻カジメ側葉の子囊班部と非子囊班部の光合成の比較研究

褐藻カジメ *Ecklonia cava* の側葉の光合成活性を子囊班部と非子囊班部について比較した。静岡県下田の鍋田湾で水深約 5 m の群落の中から採取した試料を用い，光合成ならびに呼吸を差動式検容計で測定した。側葉の光合成速度は，単位面積あたり，単位重量あたり，単位クロロフィル *a* 量あたりのいずれでも子囊班部では低く，非子囊班部では高かった。呼吸速度は，単位面積あたり及び単位クロロフィル *a* 量あたりでは子囊班部で高く非子囊班部では低かったが，単位重量あたりではほとんど同じであった。このような光合成速度ならびに呼吸速度の差は，主として子囊班部と非子囊班部の単位面積あたりの重量の差によるものである。光合成の光補償点は，子囊班部の方が非子囊班部より高かった。子囊班が形成されると，光は側葉の同化層に到達するまでに著しく減衰されるものと思われる。([1] 108 東京都港区港南4–5–7　東京水産大学藻類学研究室，[2] 104 東京都中央区豊海町4–18 (財) 日本水産資源保護協会，[3] 415 静岡県下田市 5 丁目10–1　筑波大学下田臨海実験センター)

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SHANNON's diversity index applied to some freshwater diatom assemblages in the Sakawa River System (Kanagawa Pref., Japan) and its use as an indicator of water quality

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LOBO, E. A. and KOBAYASI, H. 1990. SHANNON's diversity index applied to some freshwater diatom assemblages in the Sakawa River System (Kanagawa Pref., Japan) and its use as an indicator of water quality. Jpn. J. Phycol. 38: 229–243.

The reliability of SHANNON's diversity index as an indicator of water quality was evaluated using samples of benthic diatom assemblages collected from the Sakawa River System (Kanagawa Prefecture, Japan). The accuracy of SHANNON's index was determined in correlation with the diversity values obtained and the saprobic index calculated by using KOBAYASI and MAYAMA's grouping of river diatoms and the formula of PANTLE and BUCK. The results indicated that diatom assemblages growing in clean waters had diversity values lower than those of moderately polluted conditions and critically polluted ones, therefore, diversity in itself did not accurately coincide with water quality. Some taxonomical and ecological comments for each one of the diatom taxa identified are given.

Key Index Words: diatom assemblage—saprobic index—Shannon's diversity index—water quality.

In order to estimate the degree of water pollution using freshwater communities, especially diatoms, many diversity indices have been applied. However, mutual agreement among investigators seems to be incomplete on the following two important points: (1) Which index is more appropriate to measure the diversity of the community? (2) Can the diversity indices be used as an indicator of water quality?

As to the first question, MARGALEF (1974) and PIELOU (1975) have pointed out that an adequate diversity index must take account of some statistical requisites such as independence of the size of the sample and sampling techniques (e.g. random selection, stratified, etc.). Furthermore, the ecological point of view has to be also considered because the diversity depends not only on the numbers of the species (richness) and the number of individuals but also on the evenness (the property of a community that relates to the relative frequency of the species). Thus, the diversity is the result of the interaction between these basal indicators of the community structure. For this reason, according to PIELOU (1966), the indices belonging to the information theories such as SHANNON are adequate and the diversity value of the population, when the material is taken from a sample, should be better estimated using SHANNON's diversity index.

As to the second question, the problem has been discussed by some authors (e.g. ARCHIBALD 1972, HENDEY 1977), however, their conclusions are not in agreement. For example, ARCHIBALD (1972) working with the sequential comparison index as a measure of diatom population diversity concluded that diversity was not a reliable estimate of water quality. On the contrary, HENDEY (1977) working with inshore diatom communities concluded that SHANNON's index provided a good indication of the impact of the environment upon the diatom community and he suggested a scale for diversity values ranging from 0 to 4 where 0–1 means severe pollution, 1–2 means moderate pollution, 2–3 means slight pollution and 3–4 means slight passing to negligible pollution.

Thus, the principal aim of this work is to test the reliability of SHANNON's diversity index as an indicator of water quality using freshwater diatom assemblages.

Materials and methods

On 28 August 1987, samples of benthic diatom assemblages were collected from Dotene Haisuiro (Dotene Drainage) (St. 1), Sakawa-gawa (Sakawa River) (St. 2), Karikawa (Kari River) (St. 3) and Ayu-sawa (Ayu River) (Sts. 4, 5) (Fig. 1). All rivers are located in Kanagawa Prefecture, southeastern Central Japan.

For qualitative analyses, samples of attached diatoms were scraped off from stones more than 10 cm in diameter and fixed with formalin (KOBAYASI and MAYAMA 1982). The diatoms in these samples were cleaned with sulfuric acid and hydrochloric acid and mounted in Pleurax.

For quantitative analyses, samples were collected from 5×5 cm^2 quadrates established at random on flat surfaces of submerged stones more than 10 cm in diameter and cleaned in the same manner as described above. A minimum of 600 valves on each prepared slide were examined and all species encountered were identified and counted (KOBAYASI and MAYAMA 1982). When identification problems arose at the time of LM counting (e.g. for correct identification of *Nitzschia frustulum, N. hantzschiana* and *N. romana*), adjustment using SEM counting was made as described in LOBO *et al.* (1990).

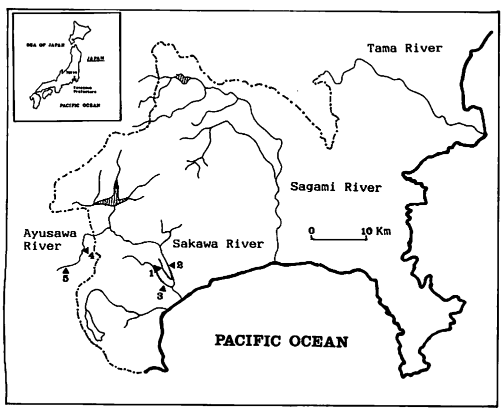


Fig. 1. Map of the study area showing the sampling stations. 1, Dotene Drainage; 2, Sakawa River; 3, Kari River; 4, downstream of the Ayusawa River; 5, upstream of the Ayusawa River.

The accuracy of SHANNON's index as an indicator of water quality was evaluated in correlation with the diversity values obtained and the saprobic indices calculated using KOBAYASI and MAYAMA's (1982) method. The method, using their grouping of species and PANTLE and BUCK's (1955) formula, is simple and easy and the results of applying this method to the Japanese river waters are in good agreement with chemical analyses (KOBAYASI and MAYAMA 1990). In the present work, the saprobic zone rating and the occurrence rating in PANTLE and BUCK's (1955) formula are replaced with the group rating (g) and the relative frequency (f%), after which the SI values of our sampling stations were calculated.

The chemical and bacteriological data of each sampling station from January 1986 to September 1987 measured by the technicians of the Kanagawa Water Supply Authority (Kanagawa Prefecture) were presented and discussed.

Results and discussion

The water quality estimation using the saprobic index indicates that the rivers examined can be rated into the following three pollution levels (Fig. 2): Level I, oligosaprobic conditions or clean water (St. 2); Level II, β-mesosaprobic conditions or moderately polluted water (Sts. 5, 4, 3); Level III, α-mesosaprobic conditions or critically polluted water (St. 1).

In addition, the chemical and bacteriological data (averages of BOD_5, total number of coliforms and conductivity) at these sampling stations are also given in Fig. 2. These data show an approximate correlation with the levels of pollution estimated by

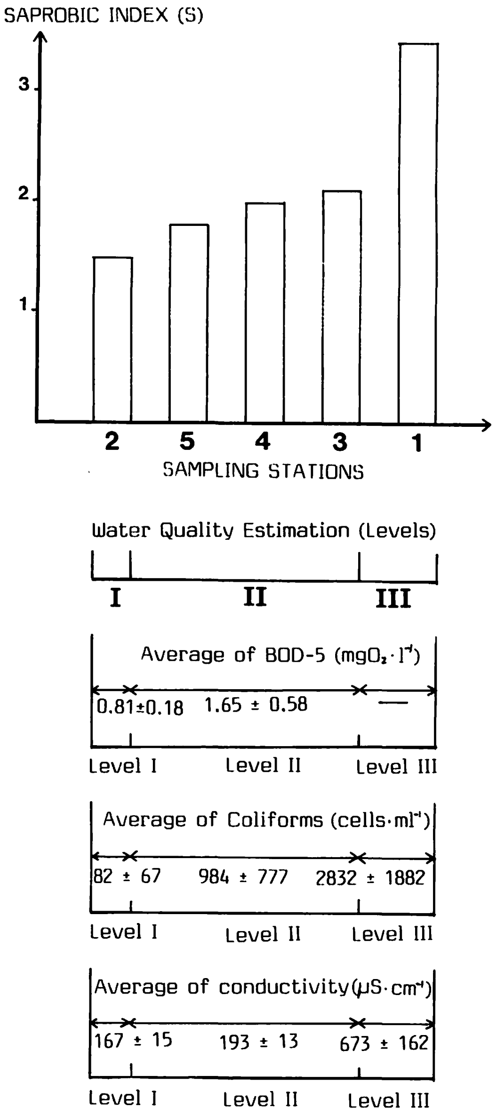


Fig. 2. Water quality estimation expressed by the saprobic index (S) using KOBAYASI and MAYAMA's (1990) grouping of river diatoms and PANTLE and BUCK's (1955) formula. Level I, oligosaprobic; Level II, β-mesosaprobic; Level III, α-mesosaprobic. For each level of saprobity, the average values of BOD_5, total number of coliforms and conductivity are given. No datum for BOD_5 at Station 1 is available.

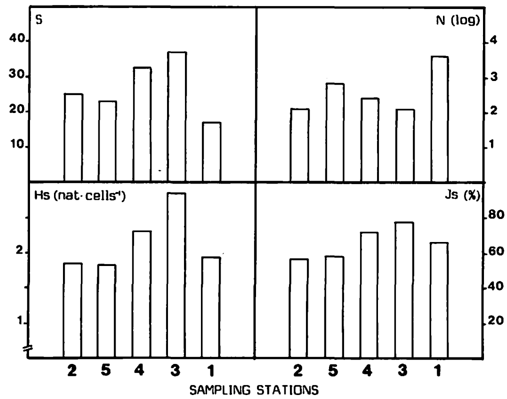


Fig. 3. Diversity indices computed. S, richness of the species; N, total cell number; Hs, SHANNON's diversity index; Js, evenness index. The stations arrangement is in agreement with in Fig. 2.

KOBAYASI and MAYAMA's (1990) method. The average of BOD_5 estimated at Stations 2, 5, 4 and 3 was less than 2.0 $mgO_2 \cdot l^{-1}$ and the sampling points can be rated to be oligosaprobic according to SLÁDEČEK (1973). On the other hand, the average total number of coliforms at Station 2 was 82 $cells \cdot ml^{-1}$ and the average at Stations belonging to Level II was 984 $cells \cdot ml^{-1}$. These values indicate oligosaprobic conditions in the former and β-mesosaprobic ones in the latter. The average number of coliforms at Station 1 was 2,832 $cells \cdot ml^{-1}$ and indicates polysaprobic conditions. Regarding the conductivity, the average value at Station 1 can be connected with polysaprobic conditions and the values at Stations 2, 5, 4 and 3 can be connected with β-mesosaprobic conditions according to MAYAMA and KOBAYASI (1984). From all the data commented on above, it can be assumed that Station 1 is α-mesosaprobic, Stations 5, 4 and 3 are β-mesosaprobic and Station 2 is oligosaprobic.

As pointed out by HENDEY (1977), in order to use SHANNON's index as a measure of water quality, it should be expected that diversity values decrease significantly from oligosaprobic to polysaprobic conditions. However, as seen in Fig. 3, the Hs value (SHANNON's diversity index) of the clean water (St. 2) was lower than those of the moderately polluted waters (Sts. 4, 3) and the critically polluted one (St. 1). These results did not follow the principle established by HENDEY (1977).

The reason why the Hs value at Station 2 was lower than those of the other stations must be considered. Regarding the other indicators of the community structure, the number of individuals (N in Fig. 3) did not show significant differences between the diatom assemblages of Levels I and II, however, the relative frequency of the species was clearly different as seen in Table 1. The community at Station 2 had fewer species than those of Stations 4 and 3 and was dominated by one taxon. As shown in Fig. 4, *Nitzschia frustulum* which is classified as a member of the pollution-sensitive Group C of KOBAYASI and MAYAMA (1990) when occurring in freshwater was dominant, being 53.8% of the relative frequency, and consequently the diversity value becomes lower.

The Hs value at Station 5 was lowest but it was classified in Level II. This situation can be explained also based on the dominant species. *Nitzschia hantzschiana* occupied 50.5% of the relative frequency and this species is classified in the less pollution-tolerant Group B of KOBAYASI and MAYAMA (1990), though this species is treated as exceptional because it was an intermediate value between sensitive and less pollution-tolerant when occurring in freshwater. For this reason, Station 5 was classified to be a moderately polluted one (β-mesosaprobic conditions) and the high percentage occurrence of *N. hantzschiana* made the value of the diversity index of diatom assemblage lower.

In the case of Stations 4 and 3, the diatom communities showed the highest values of evenness (Js in Fig. 3), i.e. the relative frequency of each species was more homogeneous than those in the communities of Levels I and III. *Nitzschia amphibia* was dominant, 23.6%, at Station 3 and *N. hantzschiana* was dominant, 20.6%, at Station 4, however, no species was exceptionally dominant over any other and consequently the Hs values of these assemblages became higher.

As the environmental conditions become worse, the number of species decreases, the sensitive species are progressively eliminated, and finally only a few of the most tolerant species remain usually in great number. This situation is illustrated at Station 1 (α-

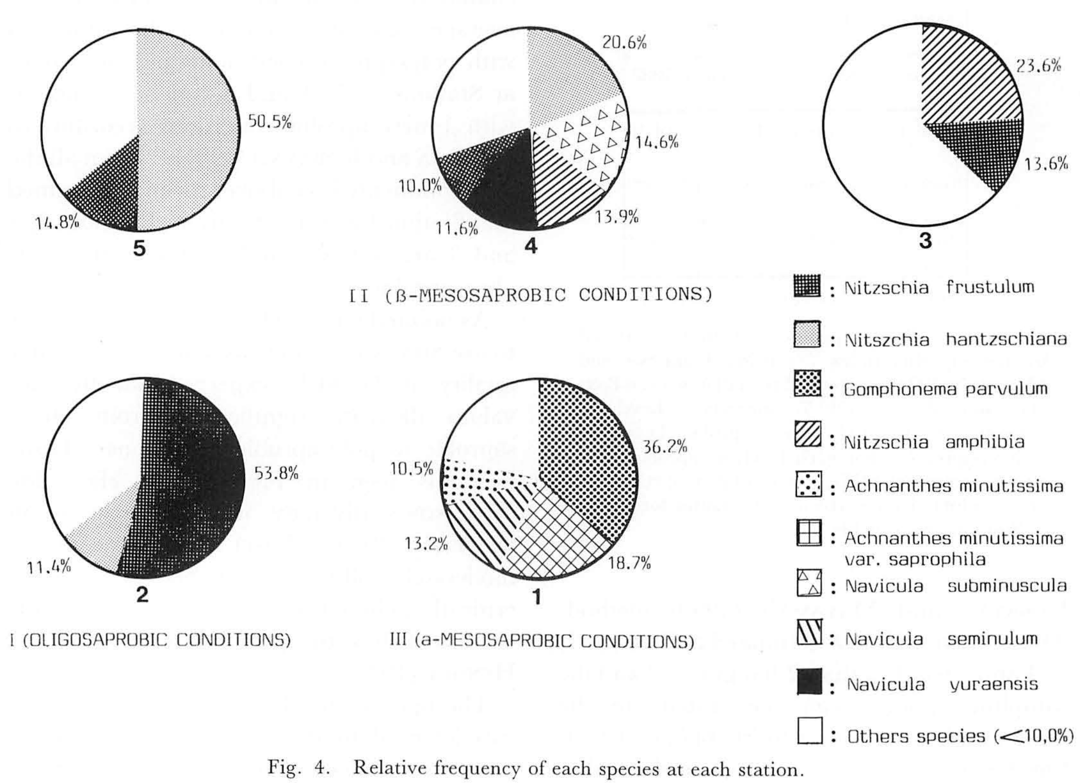


Fig. 4. Relative frequency of each species at each station.

Table 1. Relative frequencies (%) of each taxon in each sample collected from Dotene Drainage (St. 1), Sakawa River (St. 2), Kari River (St. 3) and Ayusawa River (St. 4, downstream; St. 5, upstream). g=group rating of each taxon.

Diatoms observed	g	Relative frequencies (%)				
		St. 1	St. 2	St. 3	St. 4	St. 5
Achnanthes convergens	1		0.3	0.3		
A. exigua	2.5	2.7		2.3		
A. lanceolata	1		0.3	1.8		
A. minutissima	1	10.5	4.7	3.2	1.1	5.2
A. minutissima v. *saprophila*	4	18.7				1.0
A. rostrata	1			0.3		
A. subhudsonis	1		0.3	0.3		
A. sp.	1			0.2		
Amphora veneta	1				0.2	
Anomoeoneis vitrea	1		0.3			
Asterionella formosa	1		0.9	0.3		
Bacillaria paradoxa	2.5			0.7		
Cocconeis placentula	1	0.1	2.2	4.7	0.9	1.6
Cyclotella comta v. *affinis*	1	0.3				
C. meneghiniana	2.5		0.6	0.3	0.2	
Cymbella sinuata	1		0.9	1.1	0.4	0.4
C. tumida	1				1.0	
Diatoma vulgare	1	0.1				0.2
Fragilaria brevistriata	2.5			6.5	1.8	0.2
F. capucina	1			0.2		
F. capucina v. *vaucheriae*	2.5		0.2			
F. construens	2.5	0.1		0.7	0.1	0.2
F. construens v. *subsalina*	1			0.3		
F. elliptica	2.5	0.2			0.2	
F. pinnata	2.5			6.4	1.1	
Gomphonema parvulum	4	36.2	4.3	1.4	2.0	1.9
G. gracile	1	0.4				
Navicula atomus	4				1.8	0.2
N. confervacea	2.5			1.4		
N. constans v. *symmetrica*	1			0.3		
N. cryptocephala	1			0.9		
N. cryptotenella	1			0.3	0.4	
N. goeppertiana	3.25	0.2		0.7	0.4	0.2
N. gregaria	2.5		0.5	2.6	2.7	0.6
N. minima	4	3.3	2.9	1.6	0.2	23.3
N. pupula	2.5			0.7		
N. seminulum	4	13.2	1.9	3.8	1.1	0.9
N. schoenfeldii	1	0.2				
N. subminuscula	2.5	8.9	2.0		14.6	1.3
N. tridentula	1				0.2	
N. trivialis	2.5		0.3			
N. veneta	3.25		0.2		0.2	
N. viridula v. *rostellata*	1			0.6		
v. *rostrata*	1		0.3	0.9	0.7	
N. yuraensis	1		0.3	1.8	11.6	
Nitzschia amphibia	2.5	1.6	3.0	23.6	13.9	8.9
N. frustulum	1		53.8	13.6	10.0	14.8
N. hantzschiana	1.75		11.4	7.5	20.6	50.5
N. palea	4	3.2	0.9	5.0	5.3	2.5
N. paleacea	2.5				2.3	1.1
N. romana	1		7.0	2.3	2.7	
Pinnularia burckii	1			0.2		
P. subcapitata	2.5			0.7	0.2	
Rhoicosphenia abbreviata	1				1.4	4.9
Stephanodiscus minutulus	1				0.2	0.4
Stauroneis japonica	1					0.4
Synedra ulna	2.5				0.2	
S. ungeriana	1			0.5		

mesosaprobic) where the total number of species was lowest (Fig. 3) and *Gomphonema parvulum*, classified as one of the most pollution-tolerant taxa (Group A) in KOBAYASI and MAYAMA (1990), was the dominant species, being 36.2% in relative frequency (Table 1, Fig. 4). Thus, in polysaprobic conditions, the diversity of the diatom assemblages will always be low.

The results indicate that diatom assemblages growing in clean waters (Station 2, oligosaprobic) can have a low diversity value, especially when the environmental conditions favor the development of the particular sensitive taxa. This is not impossible. Thus, the diversity itself, using SHANNON's index, did not permit accurate differentiation of the levels of pollution and therefore cannot be used alone as an indicator of water quality. However, in order to get a complete description of the diatom assemblages as an indicator of water pollution, we suggest the inclusion of the diversity component as a useful element of the biological indicator systems because the structure of the community will be better understood.

The qualitative analyses of the diatom samples collected from the rivers examined indicate a total of 58 taxa belonging to 18 genera (Table 1). The taxa identified are given below in alphabetical order together with some comments on their dimensions, structure and ecology. The references following each of the listed taxa in parentheses are those used for their identification. Reference citations are in accordance with the guide attached to the ICBN (STAFLEU *et al.* 1972).

1. *Achnanthes convergens* H. Kob. (KOBAYASI *et al.* 1986. 4. *f. 1-17, 37-43, 51-54*). (Figs. 5, 6)

The specimens observed in the area are rather small but their identity was confirmed by SEM.

2. *Achnanthes exigua* Grun. var. *exigua* (SCHOEMAN and ASHTON 1982. 84, 86. *f. 1-8, 75-79, 105-110*). (Figs. 7, 8)

Though this species is extremely variable in valve shape and striation density, SCHOEMAN and ASHTON (*l. c.*) examined Kutzing's type material from Lake Taearigua, Trinidad and other materials, and synonymized var. *constricta* and var. *heterovalvata* with the nominate variety.

3. *Achnanthes lanceolata* (Breb.) Grun. var. *lanceolata* (MOSS and CARTER 1982. 160, 161. *pl. 1. f. 1, 2, 8-15*).

Specimens with cavum are separated from this taxon under the name of *A. rostrata* Oestr.

4. *Achnanthes minutissima* Kuetz. var. *minutissima* (LANGE-BERTALOT and RUPPEL 1980. 18. *f. 74-112, 126-132, 218-304*). (Figs. 9-12, 37, 38)

5. *Achnanthes minutissima* var. *saprophila* H. Kob. & Mayama (KOBAYASI and MAYAMA 1982. 195. f. 2a-h). (Figs. 9-12, 37, 38)

In contrast to the distribution of the nominate variety, this variety was found only in heavily to excessively polluted waters in Japan.

6. *Achnanthes rostrata* Oestr. (MOSS and CARTER 1982. 160. *pl. 1. f. 3-7, 16-25*).

This taxon has long been considered by many authors to be a variety of *A. lanceolata*, however, it was clearly distinguished by MOSS and CARTER (*l. c.*) in their detailed examination of the type material. The araphid valve has a central cavum on one side.

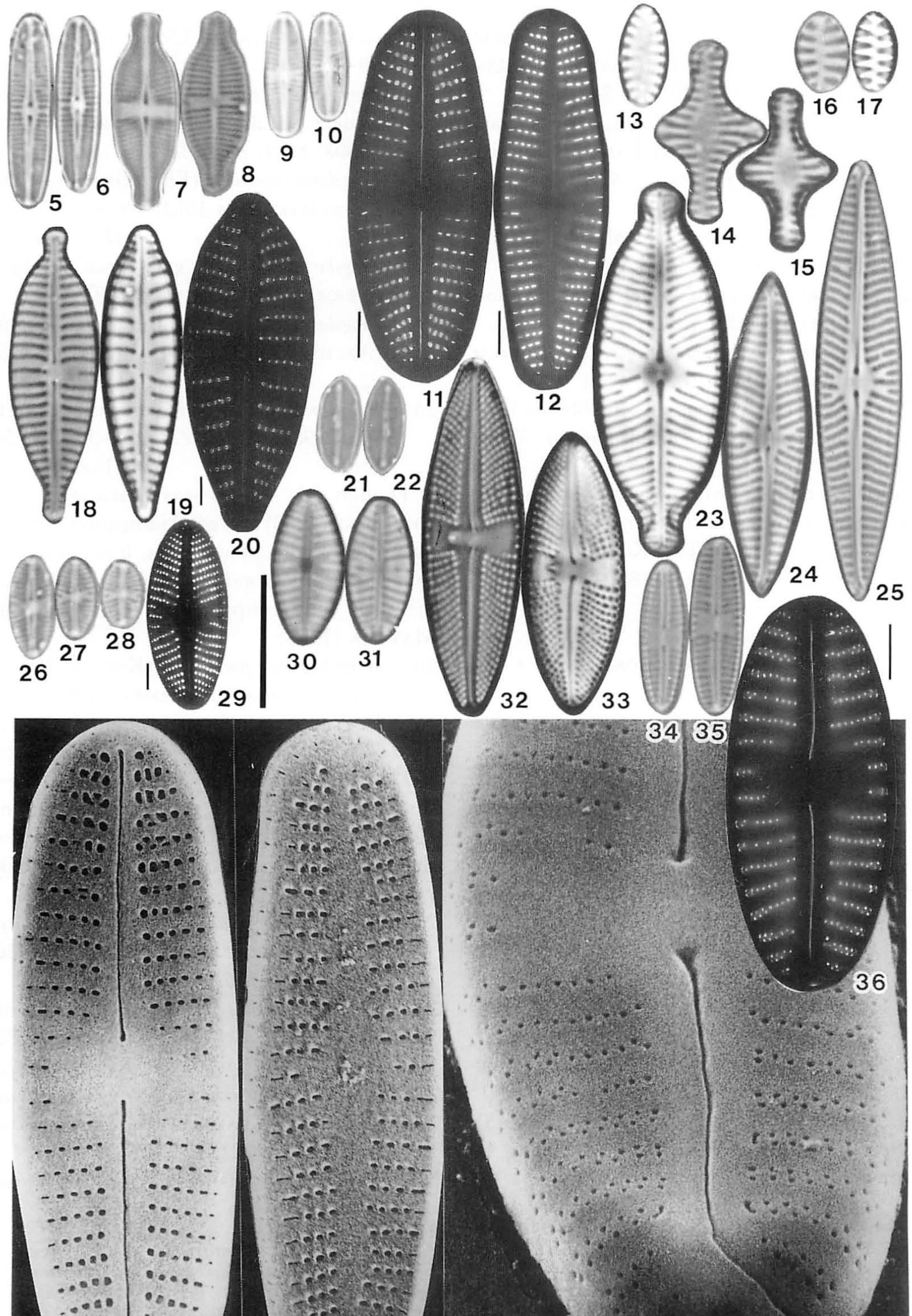
7. *Achnanthes subhudsonis* Hust. var. *subhudsonis* (SIMONSEN 1987. 54. *pl. 68. f. 1-9*).

Specimens observed in the area are rather smaller than those in the lectotype slide, photographed by SIMONSEN (*l. c.*).

8. *Achnanthes* sp.

This species resembles *A. minutissima*, however, observations using SEM showed

Plate 1. × 2,000 unless otherwise noted (broad bar = 10 μm, narrow bar = 1 μm). Figs. 5, 6. *Achnanthes convergens*. Figs. 7, 8. *A. exigua*. Figs. 9–12, 37, 38. *A. minutissima* var. *saprophila* (11, 12. TEM × 6,000; 37, 38. Exterior RV and AV, SEM × 10,000). Fig. 13. *Fragilaria brevistriata*. Figs. 14, 15. *F. construens*. Figs. 16, 17. *F. pinnata*. Figs. 18–20. *Gomphonema parvulum* (20. TEM × 4,000). Figs. 21, 22. *Navicula atomus*. Fig. 23. *N. constans* var. *symmetrica*. Figs. 24, 25. *N. cryptotenella*. Figs. 26–29. *N. minima* (29. TEM × 4,000). Figs. 30, 31. *N. schoenfeldii*. Figs. 32, 33. *N. goeppertiana*. Figs. 34–36, 39. *N. seminulum* (36. TEM × 8,000; 39. External valve, SEM × 20,000).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that these two species were not conspecific.

9. *Amphora veneta* Kuetz. var. *veneta* (SCHOEMAN and ARCHIBALD 1976-80. no. 4. *f. 1-34*, 1979. no. 5. *f. 1-38*).
10. *Anomoeoneis vitrea* (Grun.) Ross var. *vitrea* (KRAMMER and LANGE-BERTALOT 1986. 256 *f. 15/6, 94/21-28, 30, 103a/14*).
11. *Asterionella formosa* Hassal var. *formosa* (HUSTEDT 1930. 146. *f. 755*).
12. *Bacillaria paradoxa* Gmel. var. *paradoxa* (HUSTEDT 1930. 189. *f. 755*).
13. *Cocconeis placentula* Ehr. var. *placentula* (HUSTEDT 1930. 189. *f. 260*).

In the area, specimens identifiable not only as the nominate variety but also as var. *lineata* (Ehr.) V. H., var. *pseudolineata* Geitl. were found, but their variation was continuous and these were counted altogether as one taxon.

14. *Cyclotella comta* (Ehr.) Kuetz. var. *affinis* Grun. (VAN HEURCK 1880-83. *pl. 93. f. 11-13*).
15. *Cyclotella meneghiniana* Kuetz. var. *meneghiniana* (HÅKANSSON 1981. *f. 7-8, 11-13, 16*).
16. *Cymbella sinuata* Greg. var. *sinuata* (KRAMMER and LANGE-BERTALOT 1986. 341. *f. 148/10-17*).
17. *Cymbella tumida* (Breb.) V. Heurck var. *tumida* (KRAMMER and LANGE-BERTALOT 1986. 318. *f. 130/4-6*).
18. *Diatoma vulgare* Bory var. *vulgare* (WILLIAMS 1985. 75. *pl. 1. f. 1-9; pl. 6. f. 58-63; pl. 7. f. 64-70*).

Specimens found are identical with those in the lectotype slide presented by WILLIAMS (*l. c.*).

19. *Fragilaria brevistriata* Grun. var. *brevistriata* (GERMAIN 1981. 68. *pl. 20. f. 22-31*). (Fig. 13)

Specimens in the area are small, being 4-7 μm in valve length.

20. *Fragilaria capucina* Desml. var. *capucina* (LANGE-BERTALOT 1980a. 747. *pl. 2. f. 39-41*).
21. *Fragilaria capucina* var. *vaucheriae* (Kuetz.) Lange-B. (LANGE-BERTALOT 1980a. *pl. 1. f. 26-34*).
22. *Fragilaria construens* (Ehr.) Grun. var. *construens* (GERMAIN 1981. 68. *pl. 21. f. 1-19*). (Figs. 14, 15)
23. *Fragilaria construens* var. *subsalina* Hust. (GERMAIN 1981. 69. *pl. 21. f. 40-43)*
24. *Fragilaria elliptica* Schum. var. *elliptica* (ARCHIBALD 1983. 104. *f. 199-206, 519-522*).
25. *Fragilaria pinnata* Ehr. var. *pinnata* (GERMAIN 1981. 72. *pl. 21. f. 44-52; pl. 156. f. 8*). (Figs. 16, 17)

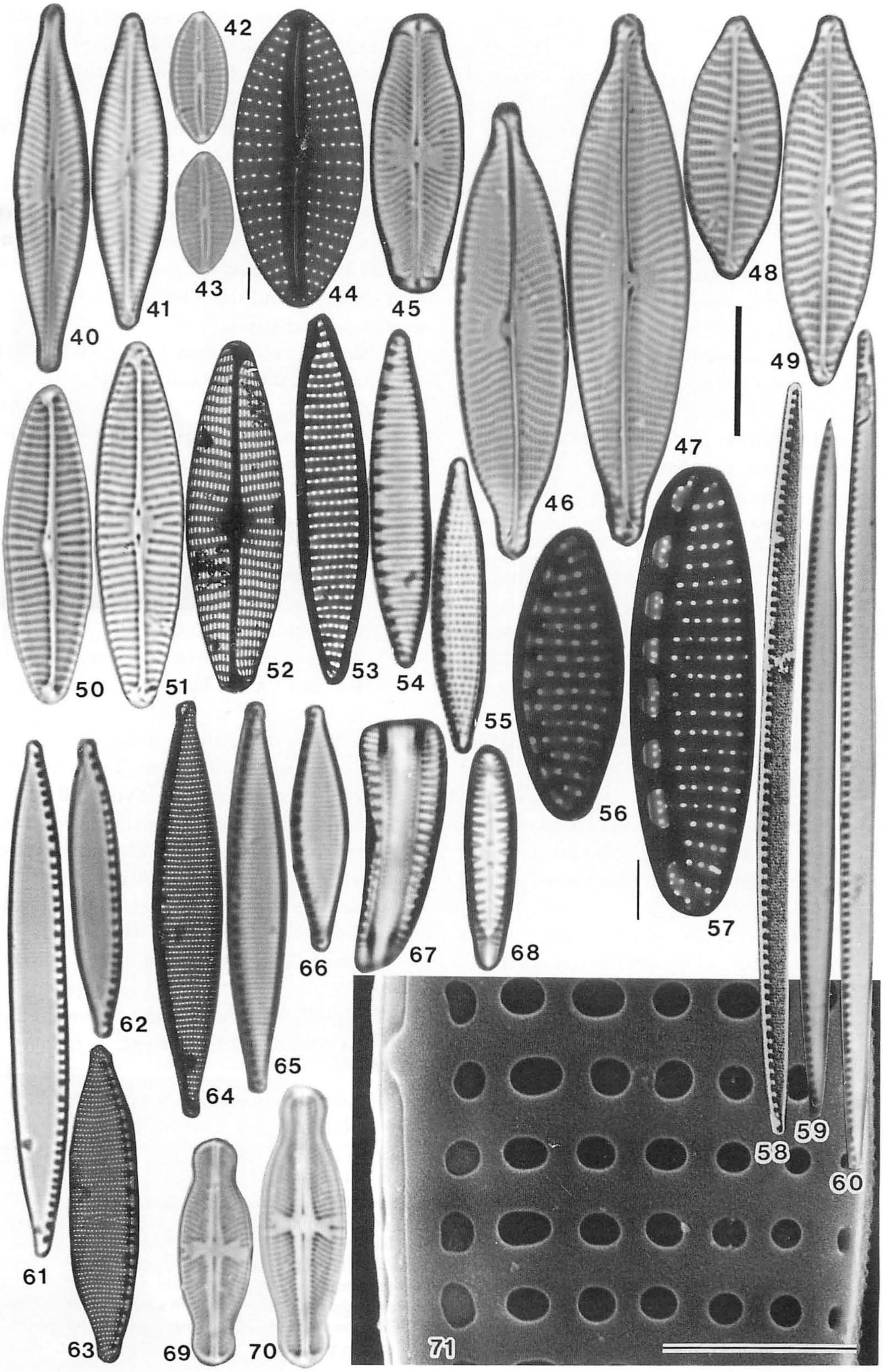
Though this species was characterized by CHOLNOKY (1968) as a good indicator of the oxygen rich oligotrophic waters, it is tolerant to α-mesosaprobic conditions and is rated as a member of Group B of KOBAYASI and MAYAMA (1990).

26. *Gomphonema parvulum* (Kuetz.) Kuetz. var. *paruvulum* (KRAMMER and LANGE-BERTALOT 1986. 358-360. *f. 154/1-25*). (Figs. 18-20)

This species is very variable in valve shape. Specimens in the area were found also to have all kinds of variations in valve shape as shown in KRAMMER and LANGE-BERTALOT (*l. c.*).

27. *Gomphonema gracile* Ehr. var. *gracile* (KRAMMER and LANGE-BERTALOT 1986. 361, 362. *f. 156/26, 27*).
28. *Navicula atomus* (Kuetz.) Grun. var. *atomus* (MAYAMA and KOBAYASI 1988. *f. 1-40*). (Figs. 21, 22)
29. *Navicula confervacea* (Kuetz.) Grun. var. *confervacea* (KRAMMER and LANGE-BERTALOT 1986. 221. *f. 75/29-31*).
30. *Navicula constans* Hust. var. *symmetrica*

Plate 2. ×2,000 unless otherwise noted (broad bar=10 μm, narrow bar=1 μm). Figs. 40, 41. *Navicula cryptocephala*. Figs. 42–44. *N. subminuscula* (44. TEM×5,000). Fig. 45. *N. pupula*. Figs. 46, 47. *N. viridula* var. *rostellata*. Figs. 48, 49. *N. viridula* var. *rostrata*. Figs. 50–52. *N. yuraensis* (52. SEM×2,000). Figs. 53–55. *Nitzschia amphibia* (53. TEM×2,000). Figs. 56, 71. *N. frustulum* (56. TEM×8,000; 71. Exterior valve center, SEM×30,000). Fig. 57. *N. hantzschiana* (TEM×9,000). Figs. 58–60. *N. paleacea* (58. Interior valve, SEM×2,000). Figs. 61–63. *N. palea* (63. TEM×2,000). Figs. 64–66. *N. romana* (64. SEM×2,000). Figs. 67, 68. *Rhoicosphenia abbreviata*. Figs. 69, 70. *Stauroneis japonica*.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This species is one of the widely distributed diatoms in the oligotrophic Japanese rivers.

46. *Nitzschia amphibia* Grun. var. *amphibia* (SCHOEMAN *et al.* 1984. 199-202. *f. 72-86*). (Figs. 53-55, 72-75)

The fine structure of our specimens coincides well with that of South African specimens. All valves have a central nodule as pointed out by SCHOEMAN *et al.* (*l. c.*) contrary to HUSTEDT's (1937-38) statement in that the central nodule appears only in larger specimens. The pore occlusions of this species are peculiar. External to the hymen with perforations arranged in a hexagonal array, a cribrum is present to form a double layer (Figs. 72-74). The cingulum consists of four open bands, a valvocopula and three bands, but as seen in Figs. 72, 73 and 75, the valvocopula and the third band are remarkably broader than the second and fourth bands.

47. *Nitzschia frustulum* (Kuetz.) Grun. var. *frustulum* (KOBAYASI 1985. 305. *pl. 3. f. 21-34*). (Figs. 56, 71)

This species is one of the most frequently and widely distributed taxa in the Japanese rivers. The striae are straight and without bifurcations on the canal raphe. The areolae composing striae are sometimes obviously irregular in both size and intervals.

48. *Nitzschia hantzschiana* Rabh. var. *hantzschiana* (KOBAYASI 1985. 312. *pl. 5. f. 44-49*). (Figs. 57, 78-81)

This species frequently occurs with *N. frustulum* in the Japanese rivers. In the area, these two species and *N. romana* have occurred mixed with each other. The clear recognition of these three species is very difficult without the employment of SEM. The striae of this species can be clearly distinguished from those of *N. frustulum* by the bifurcation of the stria on the raphe canal (Figs. 78, 81). The cingulum of this species consists of three open bands, a broad valvocopula with a row of round poroids on the pars exterior along the valve margin, and three narrow bands (Figs. 79, 80).

49. *Nitzschia palea* (Kuetz.) W. Smith (LANGE-BERTALOT 1977. 271-273. *pl. 3. f. 17-21*). (Figs. 61-63)

This species is one of the representative members of the most pollution-tolerant Group A (KOBAYASI and MAYAMA 1990).

50. *Nitzschia paleacea* Grun. (KOBAYASI 1985. 305. *pl. 1. f. 1-8*) (Figs. 58-60, 82, 83)

Valves of our specimens are 45-65 μm long and 2.1-3.0 μm wide. These measurements are somewhat larger than those hitherto observed in Japan (KOBAYASI *l.c.*). However, the fine structure is fully identical with our previous observations as well as with those of LANGE-BERTALOT (1977) and COSTE and RICARD (1980). Though LANGE-BERTALOT (*l. c.*) described this taxon as being a most frequently occurring diatom in the heavily polluted European rivers, and it was later placed in his No. 2 Group (LANGE-BERTALOT 1979), it has not been found in Japanese rivers as confirmed by SEM observations. Therefore, the present occurrence is the first recorded for Japanese rivers. We gave, tentatively, the group rating of g=2.5 to this taxon.

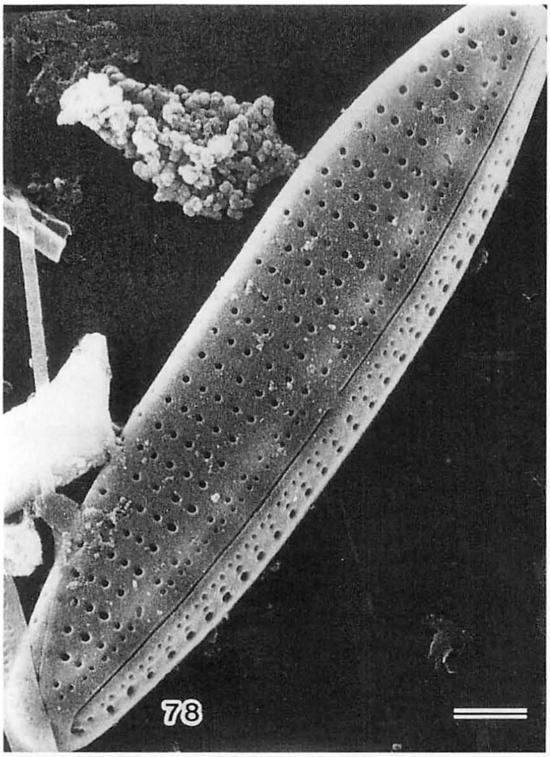
51. *Nitzschia romana* Grun. var. *romana* (KOBAYASI 1985. 312. *pl. 6. f. 56-64*). (Figs. 64-66, 76, 77)

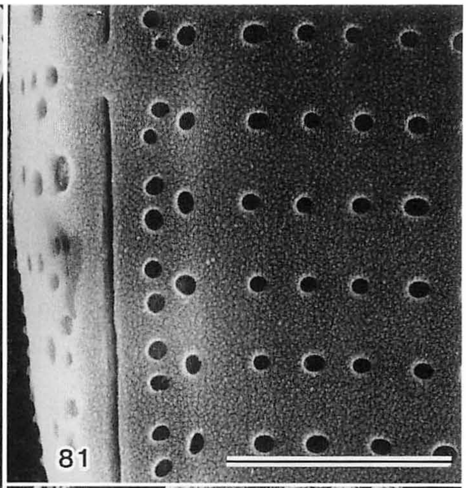
The difficulty of identification of this species only by LM is already discussed under *N. hantzschiana*. The interstriae are strongly elevated forming a corrugated surface (Fig. 76). The bifurcate striae have a furcate branch with two areolae on the raphe canal (Figs. 76, 77).

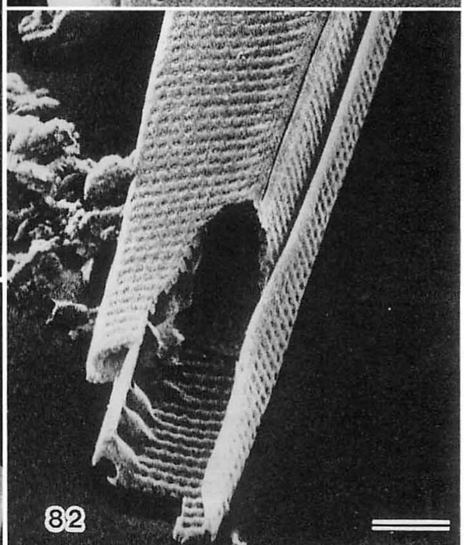
52. *Pinnularia burckii* Patr. (PATRICK and REIMER 1966. 596. *pl. 55. f. 7*).

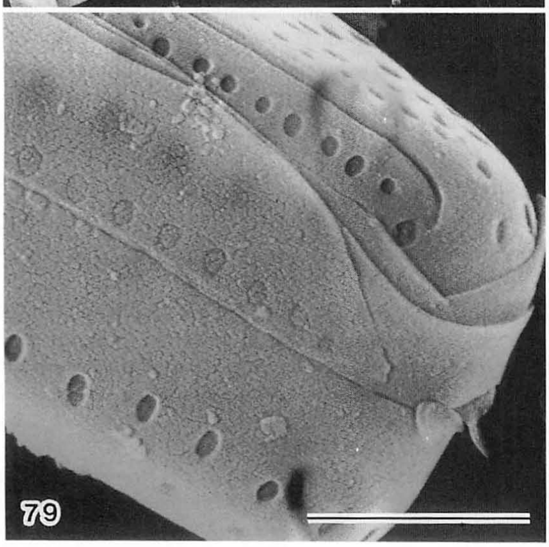
53. *Pinnularia subcapitata* Greg. var. *sub-*

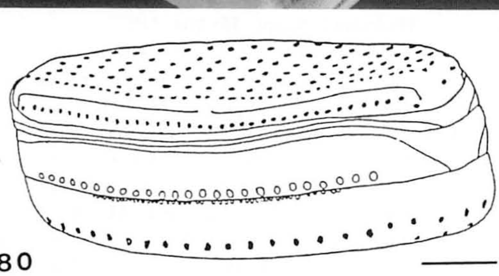
Plate 4. Fine structure of small *Nitzschia* (narrow bar=1 μm). Figs. 78-81. *Nitzschia hantzschiana*. 78. Whole valve, ×10,000; 79. Exterior frustule end showing the band morphology, SEM×30,000; 80. Diagrammatic representation of the frustule showing the band morphology, ×10,000; 81. Enlargement of exterior valve center showing the bifurcate striae and the central raphe endings, SEM×30,000. Figs. 82, 83. *N. paleacea*. 82. Broken valve end, SEM×10,000; 83. External girdle view of the frustule end showing the band morphology, SEM×20,000.











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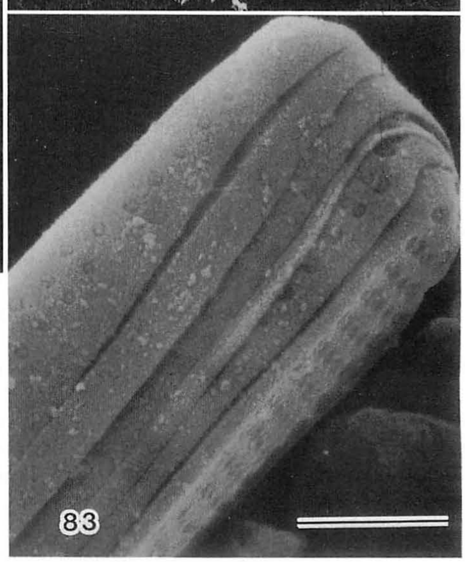

capitata (KRAMMER and LANGE-BERTALOT 1986. 426. *f. 193/1-3*).

54. *Rhoicosphenia abbreviata* (C. Ag.) Lange-B. (LANGE-BERTALOT 1980b. 586-589. *f. 1A., 3CD, 5A*). (Figs. 67, 68)
55. *Stephanodiscus minutulus* (Kuetz.) Round (KOBAYASI *et al.* 1985. 293-300. *f. 1-25*).
56. *Stauroneis japonica* H. Kob. (KOBAYASI and MAYAMA 1986. 97. *f. 13-21*). (Figs. 69, 70)
57. *Synedra ungeriana* (Grun.) Williams (WILLIAMS 1986. 135. *f. 10-18*).
58. *Synedra ulna* (Nitzsch.) Ehr. var. *ulna* (WILLIAMS 1986. 133. *f. 1-9*).

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LOBO E. A.*・小林 弘**：酒匂川水系（神奈川県）の珪藻集団に対するシャノンの多様性指数の適用とその水質の指標としての使用の可否

シャノンの多様性指数が果してどの程度水質判定に役立つものであるかを，酒匂川水系の淡水域 4 地点から採取した珪藻集団を用いて検討した。小林・真山のグループ分けとパントル・バックの式を用いて計測した汚濁指数及び他のいくつかの指数とシャノンの多様性指数を比較したところ，比較的清澄な水域に生育する珪藻集団のそれは，適度に汚染されたところ（β-中腐水）や，より汚染の進行したところ（α/β-中腐水）の値よりも，より低く，シャノンの多様性指数それ自体は正確に水質を指示しないことが分かった。なお，出現した種類について，必要に応じて分類学的並びに生態学的考察を加えた。(*Faculdades Integrades de Santa Cruz do Sul, RS, Brasil.; **184 東京都小金井市本町3-8-9-813 東京珪藻研究所)

Jpn. J. Phycol. (Sôrui) 38: 245-251, September 20, 1990

The life history of *Griffithsia japonica* OKAMURA (Rhodophyceae, Ceramiales) in laboratory culture*

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IIMA, M. and MIGITA, S. 1990. The life history of *Griffithsia japonica* OKAMURA (Rhodophyceae, Ceramiales) in laboratory culture. Jpn. J. Phycol. 38: 245-251.

The life history of the marine red alga *Griffithsia japonica* OKAMURA, collected from Saikai-bashi, Nagasaki Pref., Kyushu, Japan was studied in laboratory culture. Tetraspores released from a field-collected plant developed into uniseriate dichotomously branched male or female plants within two months. After fertilization, female plants formed cystocarps surrounded by one-celled incurved involucres. Carpospores released from these culture plants developed into tetrasporophytes which discharged tetraspores after two months. Thus, in laboratory culture, the life history of *G. japonica* was completed within four months. This species can also easily fragment and each detached fragment can regenerate into a new plant as reported in other *Griffithsia* species.

*Key Index Words: Ceramiaceae—Ceramiales—*Griffithsia japonica*—life history—Rhodophyceae.*

Griffithsia japonica OKAMURA is an epilithic or epiphytic dichotomously branched filamentous red alga which grows in the intertidal and subtidal zones on the Pacific and East China Sea coasts of Japan. Plants of the genus *Griffithsia* (named after the British phycologist, Amelia W. GRIFFITHS) have uniseriate uncorticated axes of characteristically large vegetative cells which are visible to the unaided eye (ca. 500-700 μm diam. in *G. japonica*). Moreover each cell has the ability to regenerate into a new plant. Because of these features, *Griffithsia* has been widely used in cytological (MYERS *et al.* 1956, PRILOU 1962, RAMUS 1971) and morphogenetic studies (DUFFIELD *et al.* 1972, WAALAND and CLELAND 1972, 1974, WAALAND *et al.* 1972, WAALAND and WAALAND 1975, WAALAND 1978).

In spite of its characteristic morphology, this group (tribe Griffithsieae) is a taxonomically complicated group (ITONO 1981). Various taxonomic criterions in this tribe have been proposed by many workers (KYLIN 1956, HOMMERSAND 1963, BALDOCK 1976).

On the other hand, little information has been published on the reproduction and life history of *Griffithsia*. Only LEWIS (1909) reported the reproduction and subsequent development of *G. bornetiana*.

YENDO (1909) first reported *Griffithsia japonica* from Japan as *G. schousboei* MONTAGNE, a species found on Atlantic and Mediterranean coasts. Subsequently OKAMURA (1930) described the Japanese taxon as a new species, *G. japonica*, on the basis of its differences in morphology and distribution from *G. schousboei*. Since then, the distribution of *G. japonica* has been confirmed as southern parts of Japan (cf. SEGAWA 1956) and China (TSENG 1942). However there has been no report on the life history of this species, or of the genus *Griffithsia*, in Japan. Hence an attempt has been made in the present study to follow the life history of *G. japonica* in laboratory culture.

* Dedicated to the memory of the late Dr. Munenao KUROGI (1921-1988), Professor Emeritus of Hokkaido University.

Materials and methods

Culture studies were initially started from tetrasporophyte as this was the predominant phase in the field populations of *Griffithsia japonica*.

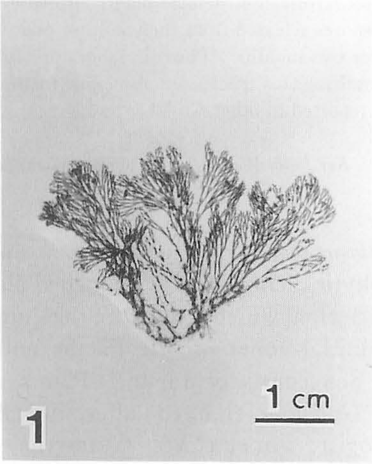
Fertile tetrasporic plants were collected at Saikai-bashi, Nagasaki Pref. and brought to the laboratory on May 29, 1987, June 4 and June 15, 1988. Plants were rinsed in filtered seawater and placed in Petri dishes (6 × 2 cm) containing 20–30 m*l* sterile seawater for few hours to induce spore liberation. The released tetraspores were rinsed several times with filtered seawater from a capillary pipette and inoculated into culture vessels (7 × 2 cm) containing 40 m*l* of PES medium (PROVASOLI 1966). The dishes were then maintained at 18–20°C under cool-white 40W fluorescent lamps at 2000–3000 lux, and a $12:\overline{12}$ photoperiod. The medium in the culture vessels was renewed weekly. When germlings grew up to about 5 mm in height, they were transferred to aeration cultures.

Chromosome counts were made using plants cultured from carpospores. Mature tetrasporophytes were fixed in ethanol : acetic acid (3 : 1 v/v) and stained with an aceto-iron-haematoxylin-chloral hydrate solution (WITTMANN 1965).

Results

Griffithsia japonica is a dichotomously branched filamentous alga which grows up to 2–5 cm in height (Fig. 1). Most of the plants found in the field were tetrasporophytes, with very few female gametophytes bearing cystocarps and no male plants found. Tetrasporangial fascicles appear in whorls around the second joint from the apex and each fascicle bears a single inflated involucral cell recurved to enclose the tetrasporangial clusters (Fig. 2). The tetraspores are spherical (35–40 μm in diam.) and dark red in color (Fig. 3-A). In culture, released tetraspores attached to the substratum within a few hours and germinated by forming an elongated hyaline rhizoidal cell, and an apical cell which later divided to form the thallus. Within 3 days, germlings developed to a 3-celled stage about 150 μm in length and 50 μm in width (Fig. 3-B). Within one week, cell number increased to more than 10 cells and new lateral branches were produced (Fig. 3-C). After 21 days, germlings were about 2–3 mm in length (Fig. 3-D) and became detached from the substratum (glass surface). At this stage, the free-living germlings were transferred into aeration flasks. The germlings grew up to 1–2 cm in length after 40 days in aeration culture (Fig. 3-E).

Spermatangia (Fig. 3-F) formed in whorls



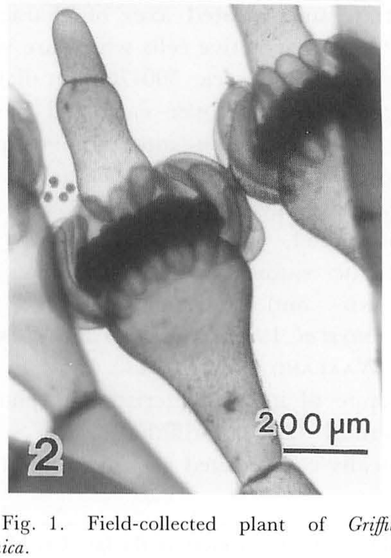


Fig. 1. Field-collected plant of *Griffithsia japonica*.

Fig. 2. Branches with tetrasporangia releasing tetraspores.

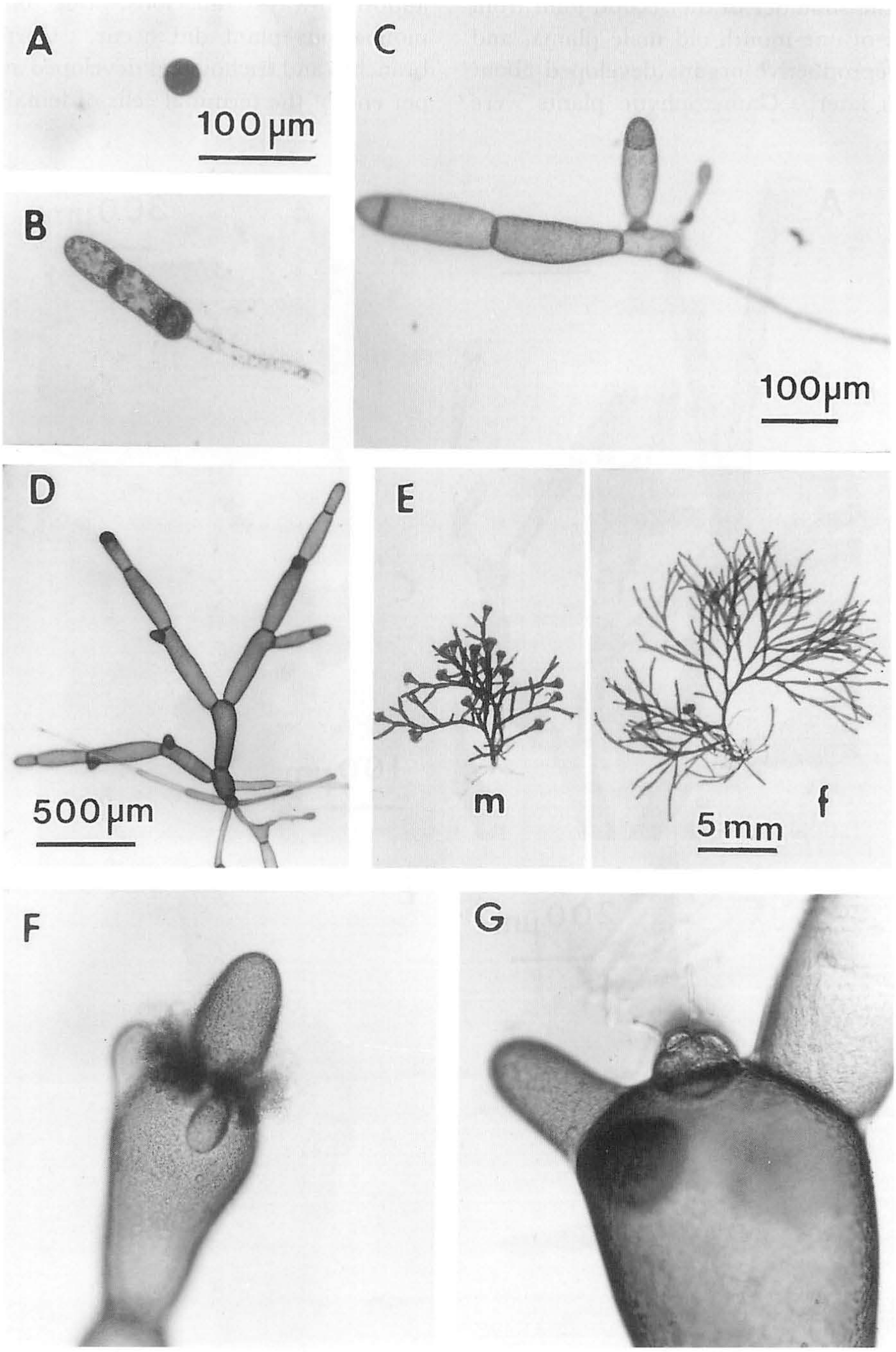


Fig. 3. Development of tetraspore. A. Tetraspore released from tetrasporangium. B. Three-day-old germling with hyaline rhizoidal cell. C. Seven-day-old plant with a branch. D. Twenty-one-day-old plant with pseudodichotomous branches. E. Forty-day-old plants with reproductive organs (m, male plant; f, female plant). F. Spermatangia of male plant releasing spermatia. G. Procarps of female plant with two trichogynes. Scale in A applies also to B, F and G.

around the shoulder of the second joint from the apex of one-month-old male plants, and female reproductive organs developed about ten days later. Gametophytic plants were almost always dioecious, but only one monoecious plant did occur. Carpogonial branches and trichogynes developed at the upper end of the terminal cells of female plants

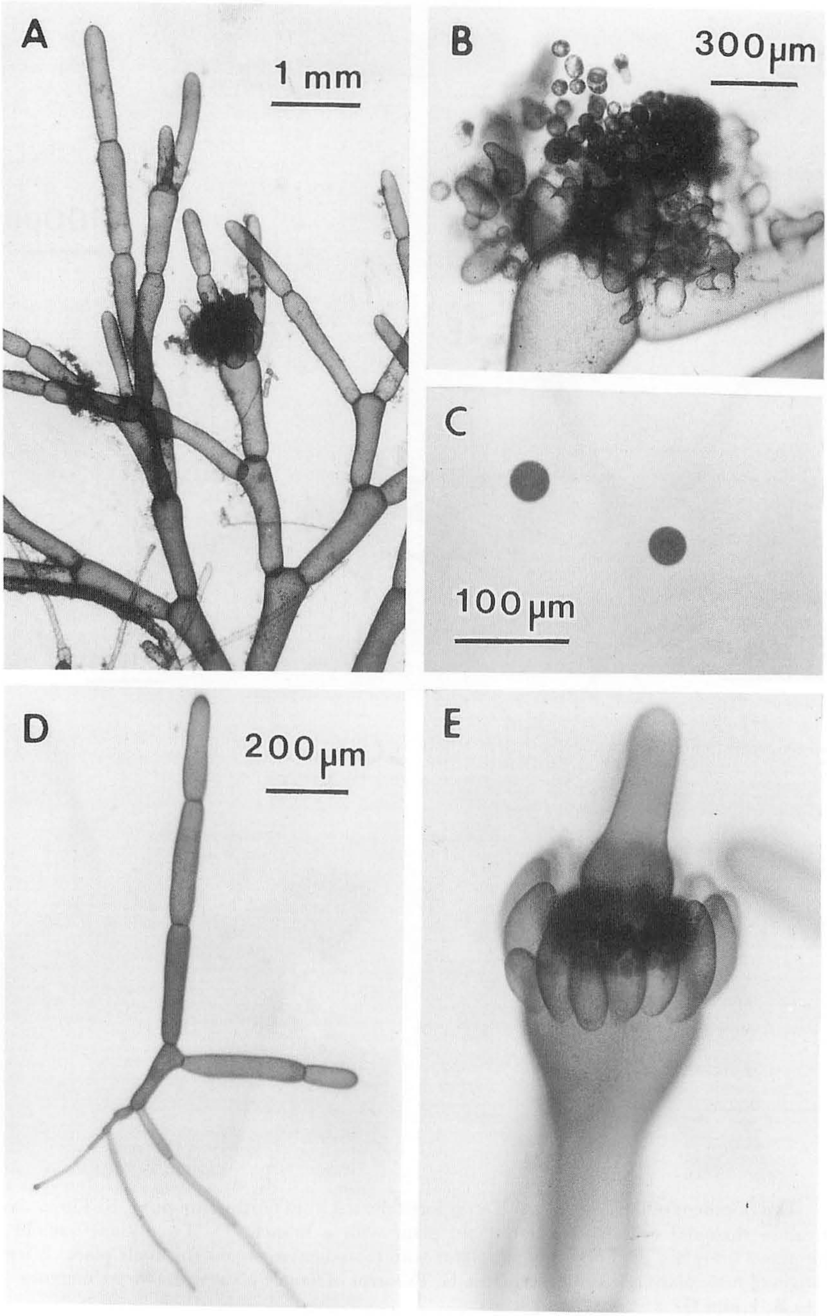


Fig. 4. Development of carpospore released from cultured plant. A. Branch with mature cystocarp. B. Mature cystocarp releasing carpospores. C. Carpospores from cultured plant. D. Fourteen-day-old germling from carpospore. E. Mature tetrasporangial clusters of cultured plant. Scale in C applies also to E.

(Fig. 3-G).

The spermatia released from spermatangia attached to trichogynes and ultimately resulted in the formation of cystocarps (Fig. 4-A). Carpospores were released (Fig. 4-B) within 2 months of germination. The released carpospores were 35–40 μm in diameter (Fig. 4-C). The germination pattern and development of the carpospores were identical to those of the tetraspores (Fig. 4-D).

After two months in culture, germlings derived from carpospores formed tetrasporangial fascicles with 14–16 one-celled incurved involucres (Fig. 4-E). The morphology of the tetrasporangia was the same as in field-collected plants.

The chromosome number was about 20 (n) in tetrasporangia (Fig. 5). Unfortunately chromosomes in the diploid stage (2n) or during meiosis were not observed in the present study.

Some mature vegetative filaments were fragmented into single cells and maintained in culture under the same conditions. Most of the fragments regenerated into normal plants as reported earlier for other species of *Griffithsia* (Duffield *et al.* 1972).

Discussion

All phases in the life history of *Griffithsia japonica* were observed over 4 months in laboratory culture. Germlings derived from tetraspores developed into dioecious male and female gametophytes and, after fertilization, cystocarps were formed. The carpospores released from cystocarps subsequently developed into tetrasporophytes. *G. japonica*, therefore, has a triphasic *Polysiphonia*-type life history, having dioecious gametophytes, an isomorphic tetrasporophyte, and a carposporophyte which remains attached to the female gametophyte. Such a life history is reported to be common in other members of the Ceramiales (cf. West and Hommersand 1981).

Edwards (1968, 1969, 1973) reported other types of life history, in addition to the *Polysiphonia*-type, in some members of the Ceramiales, but *G. japonica* showed only the *Polysiphonia*-type of life history in the present study.

In the field, *G. japonica* is abundant during spring (April to June), then disappears in summer (July or August). At the beginning of this study, tetraspores from *G. japonica* were

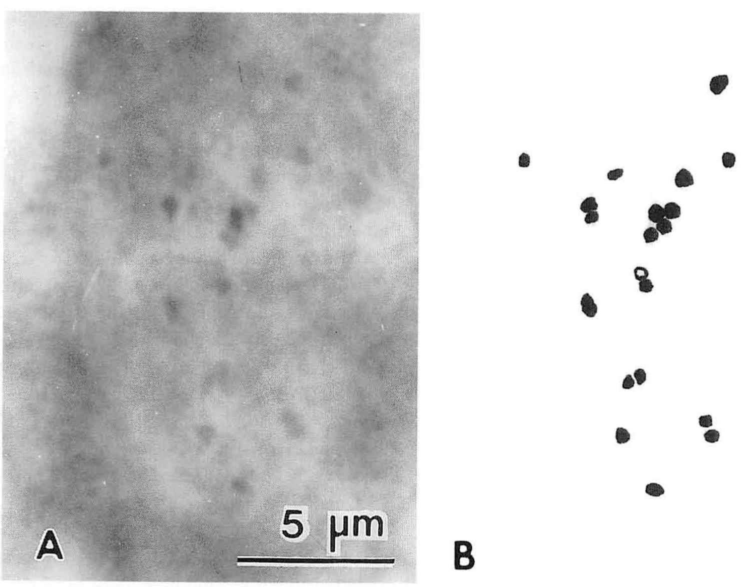


Fig. 5. A. Chromosomes in the tetrasporangium (about 20). B. Drawing of A.

cultured at 18-20°C and, simultaneously, at room temperature (above 25°C). While spores cultured at the former temperature could germinate, those of the latter did not and gradually degenerated. This may indicate the inhibition of germination at higher temperatures, perhaps together with other factors, which may inhibit growth of *G. japonica* in the field in summer.

The early development of this species appears to be similar to that of *G. bornetiana* (LEWIS 1909). LEWIS (1909) observed that the 3-cell stage was reached about twelve hours after the spore was shed. However, in the present study, *G. japonica* did not reach the 3-cell stage until the second day after settlement.

Morphological features typical of plants in the field were also observed in plants grown in culture; the filamentous plants being dichotomously branched with giant vegetative cells and tetrasporangial fascicles surrounded by one-celled incurved involucres around the second joint from the apex. Such features are characteristics of the tribe Griffithsieae (ITONO 1981).

However, as NORRIS and MOLLOY (1988) recently reported in the culture experiments of *Griffithsia schousboei*, many rhizoids were produced in cultured plants though they appeared to less common in the original field-collected plants.

The chromosome number of *Griffithsia japonica* (n=ca. 20) corresponds with that reported for *G. corallina* (KYLIN 1916; n=20, 2n=40), but differs from that of *G. bornetiana* (LEWIS 1909; n=7, 2n=11-14).

In the present study, *Griffithsia japonica* from Japan was found to be easily cultured in the laboratory. The species therefore has potential for use in cytological and morphogenetic studies as performed with other *Griffithsia* species.

Acknowledgements

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飯間雅文・右田清治：室内培養における紅藻カザシグサ *Griffithsia japonica* の生活史

長崎産紅藻カザシグサ *Griffithsia japonica* OKAMURA（イギス目，イギス科）の発生・生活史が，室内単藻培養で調べられた。天然藻体から放出された四分胞子の発芽体は培養2ヵ月後には体長約1 cmとなり成熟し，雌雄異株で頂端部にそれぞれ受精毛と精子器が形成された。雌性配偶体では受精後，嚢果が形成され，果胞子が放出された。放出された果胞子は四分胞子と同様の発生を行い，発芽後約2ヵ月で成熟し，四分胞子を放出した。培養藻体の四分胞子嚢が十数本の輪生枝に囲まれて形成されるなどの形態的特徴は，天然藻体と同様であった。カザシグサは，四分胞子体と雌雄配偶体が同形のイトグサ型生活史を行っていることが明らかとなった。染色体数は，四分胞子嚢の細胞分裂時でn＝ca. 20と観察された。また，この種は他のカザシグサ属の種で報告されているように，切断された藻体の枝は容易に新個体に再生した。（852 長崎市文教町1-14　長崎大学水産学部藻類増殖学研究室）

Jpn. J. Phycol. (Sôrui) 38: 253-261, September 20, 1990

Fine structure of the marine pennate diatom *Entomoneis decussata* (GRUN.) comb. nov.

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Osada, K. and KOBAYASI, H. 1990. Fine structure of the marine pennate diatom *Entomoneis decussata* (GRUN.) comb. nov. Jpn. J. Phycol. 38: 253-261.

The fine structure of *Entomoneis decussata* collected from Japanese marine habitats has been examined using mainly electron microscopy to clarify stable features of this taxon. Through the reproduction process in clonal cultures, valves of both maximum and minimum size were produced and then compared. The taxon has the following morphological features recognizable to be stable and characteristic: 1) Decussating wing costae with many linking fibulae: 2) Arcuate junction line formed by a row of basal fibulae fusing with each other into H or Y shape in places: 3) Spines on the costae of the valve body: 4) Density of striae, being 22-26 in 10 μm: 5) Perforations arranged in a line of the hymenate areolar occlusion of the valve: 6) Externally raised interareolar costae and numerous warts on the surface of the band.

Key Index Words: *clonal culture*—Entomoneis—Entomoneis decussata—*fine structure*—*marine diatom.*

The species, *Entomoneis decussata*, was originally described by GRUNOW (CLEVE and GRUNOW 1880) as *Amphiprora decussata*. In the original description, the valve dimensions of 63-65 μm long, 21-24 striae in 10 μm, and the presence of a keel with decussate lines were given, but the figures were not given. However, GRUNOW's figure was presented in VAN HEURCK's (1880) atlas. The figure which measured 64 μm long and about 22 striae in 10 μm seems to coincide well with the original description. The taxon was later included in *Amphiprora gigantea* Grun. as one of its varieties by CLEVE (1894) based on only the similarity in its decussate puncta on the wings. Although there had been a few records of this taxon in literature, POULIN *et al.* (1987) recently reported the taxon under a new name combination, *E. gigantea* var. *decussata*.

Our light (LM) and electron microscopical (SEM and TEM) examinations of this taxon collected from two Japanese marine habitats and the clonal cultures obtained showed that the taxon should be better classified as a separate species.

A new nomenclatural combination to the genus *Entomoneis* is proposed.

Material and methods

Materials were collected from the bottom mud of the coast of Shimabara-wan (Shimabara Bay), Misumi-cho, Kumamoto Pref., on October 12, 1986 (OS-381) and from a culture tank of abalones in the Yamagata Prefectural Fisheries Experimental Station, Tsuruoka City, Yamagata Pref., on January 20, 1988 (OS-425). Some individuals from the latter were isolated into clonal cultures and grown in Erlenmeyer flasks containing a modified PES medium (OSADA and KOBAYASI 1990). The cultures were maintained at 18°C under fluorescent light of about 2000 lux with a 14/10 light-dark cycle. When the culture materials were transferred to a fresh medium about three months later from the first inoculation, auxospore formation was induced (KE-1554-3).

To obtain cleaned specimens all materials were treated by the method in KOBAYASI *et al.* (1985). The specimens were embedded in Pleurax for light microscopy (LM). For SEM, the specimens were dried naturally or critical point drying and then coated with platinum-palladium using a HITACHI E-102. The specimens for TEM were placed on formvar-coated copper grids. SEM and TEM observations were made using a HITACHI S-800 and a JEOL 1200EX respectively.

The terminology used is that suggested by ANONYMOUS (1975), ROSS *et al.* (1979) and PADDOCK and SIMS (1977, 1981).

Observations and discussion

The frustules are panduriform in outline constricted deeply on both sides of the valve centre from a girdle view, because of the strong bilobate keel of the valve. The keel is divided into two wings by a lower central nodule (Figs. 1, 3, 5, 6, 22). In the valve view, the valve is linear-lanceolate with acute ends and the keel is sigmoid (Fig. 2). In LM, the valve body and the wing are separated clearly by an obvious junction line. These two parts have clearly different structures from each other. The wing is composed of peripheral hyaline region with the raphe and the region with decussating rows of small puncta, while the valve body bears transapical striae throughout. The valves are 40-66 μm long and about 7-12 μm wide, and have 22-26 striae in 10 μm. The junction lines are arcuate. The above features of our specimens agree fairly well with both GRUNOW's original description (CLEVE and GRUNOW 1880. p. 63) and his illustration in VAN HEURCK (1880. pl. 22. f. 13). However, our specimens seem to be different from POULIN *et al.*'s (1987) *E. gigantea* var. *decussata* which has short striae along the raphe canal in their light micrographs.

In one clonal culture (KE-1554-3) containing auxospores, mother valves of 26-30 μm long (Fig. 5) and large auxospores or valves which attain a maximum size of 71-87 μm long (Fig. 6) by the sexual reproduction process are observed. The LM structures of the valve body and the wing, i.e. the striae density and the shape of the junction line, are not observed to vary so markedly among specimens in the field materials nor between field and cultured specimens. The valve length of this species is considered to be at least in a range from 26 to 87 μm.

In SEM and TEM, the costae continue from the valve edge to the raphe canal at the distal margin of the wing (Figs. 4, 7, 8). The wing costae on the two walls forming a wing are decussate in the girdle view (Fig. 4). The wing costae on one half of the keel are arranged obliquely and in parallel slanting toward the apex, while on the other wing of the same keel almost all the costae are arranged also slanting in the same direction as the former but change their direction radially only at the apex (Figs. 7, 8). Many small spines are on the valve body costae externally but not on the wing costae (Figs. 7, 8, 13, 18). Each intercosta forming a stria also continues from the valve margin to the raphe canal across the junction line, and has two rows of areolae and randomly distributed external small spines (Figs. 9, 10). The areolae of the valve body are round, 160-175 in 10 μm, while those of the wing are extremely elongated, 40-90 in 10 μm. Each of the areolae bears an externally swollen pore occlusion in the same manner as that of *E. alata* var. *japonica* (OSADA and KOBAYASI 1985) and of *E. paludosa* (OSADA and KOBAYASI 1990) (Figs. 10, 11). However, the pore occlusion of this species is a hymen with perforations forming lines arranged in parallel (Figs. 10-12). Such an arrangement of the perforations is clearly different from those of *E. alata* (MANN 1981), *E. alata* var. *japonica* (OSADA and KOBAYASI 1985) and *E. paludosa* (OSADA and KOBAYASI 1990), and also can be distinguished from the parallel array type described by KOBAYASI and NAGUMO (1985).

In broken valves, the small puncta on the wing seen in LM are the fibulae linking costae on opposite walls of the wing (Figs. 18, 19). The outermost fibulae, raphe fibulae, are arranged in a row and separate proximally the

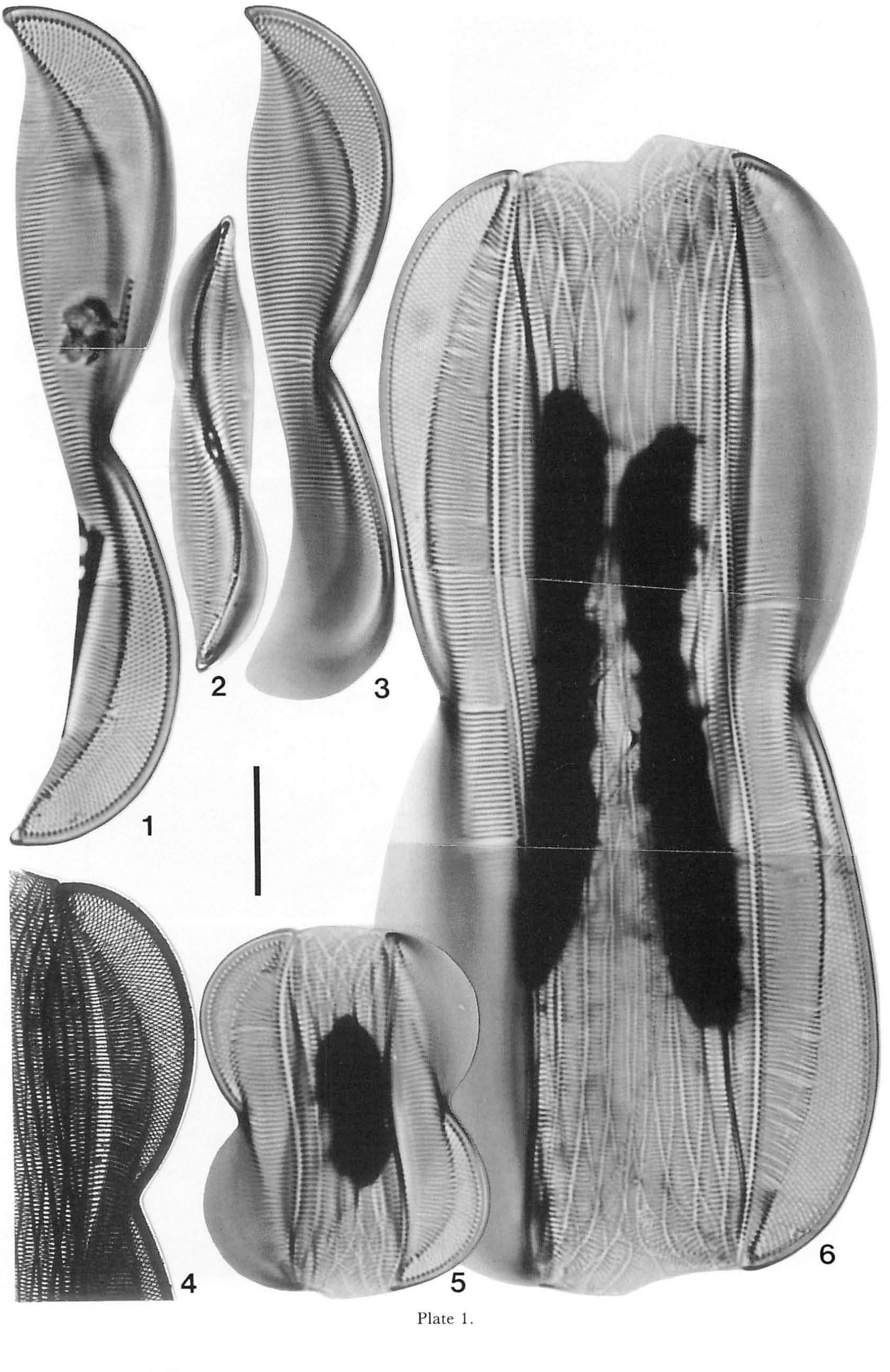

Plate 1.

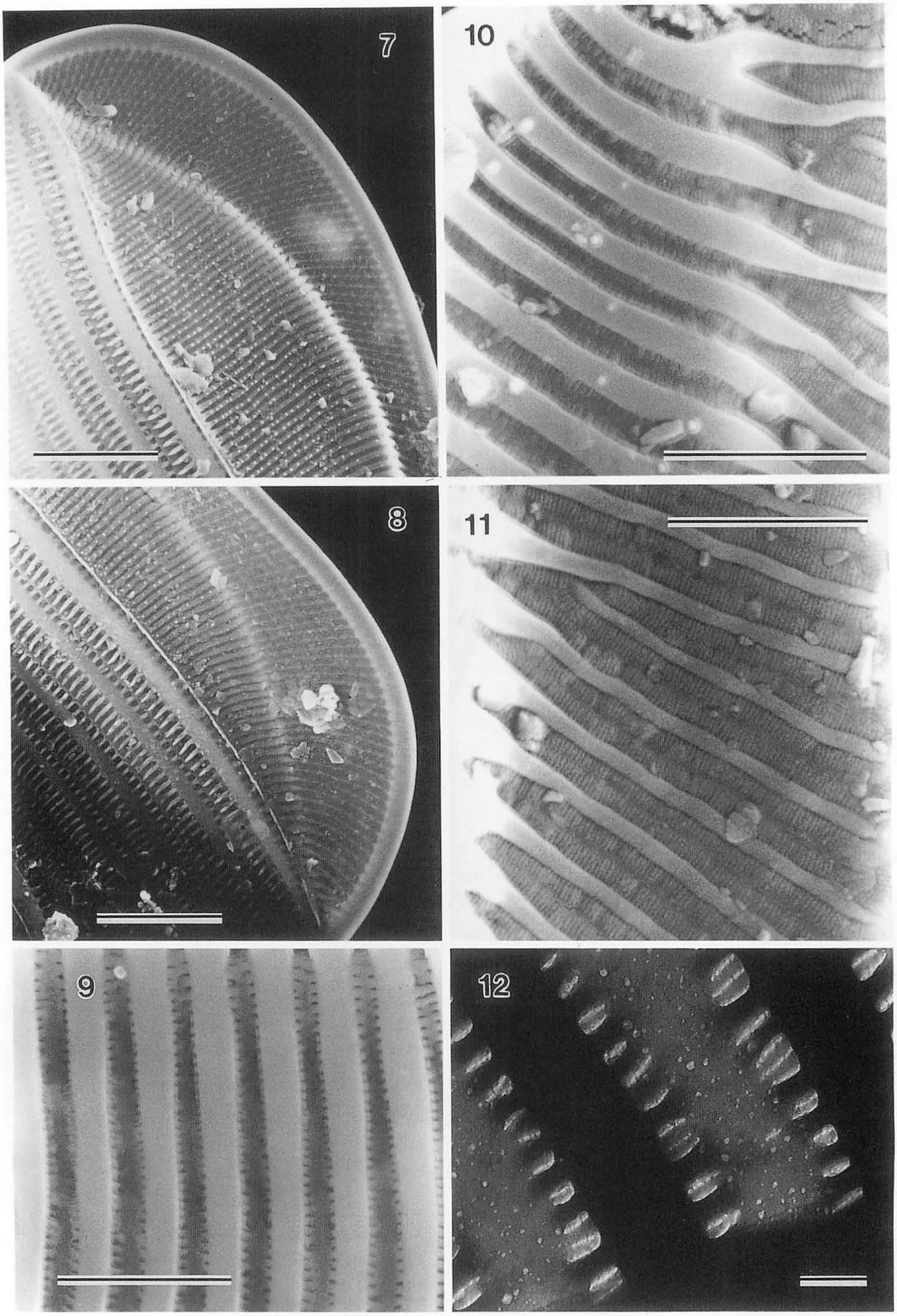

Plate 2.

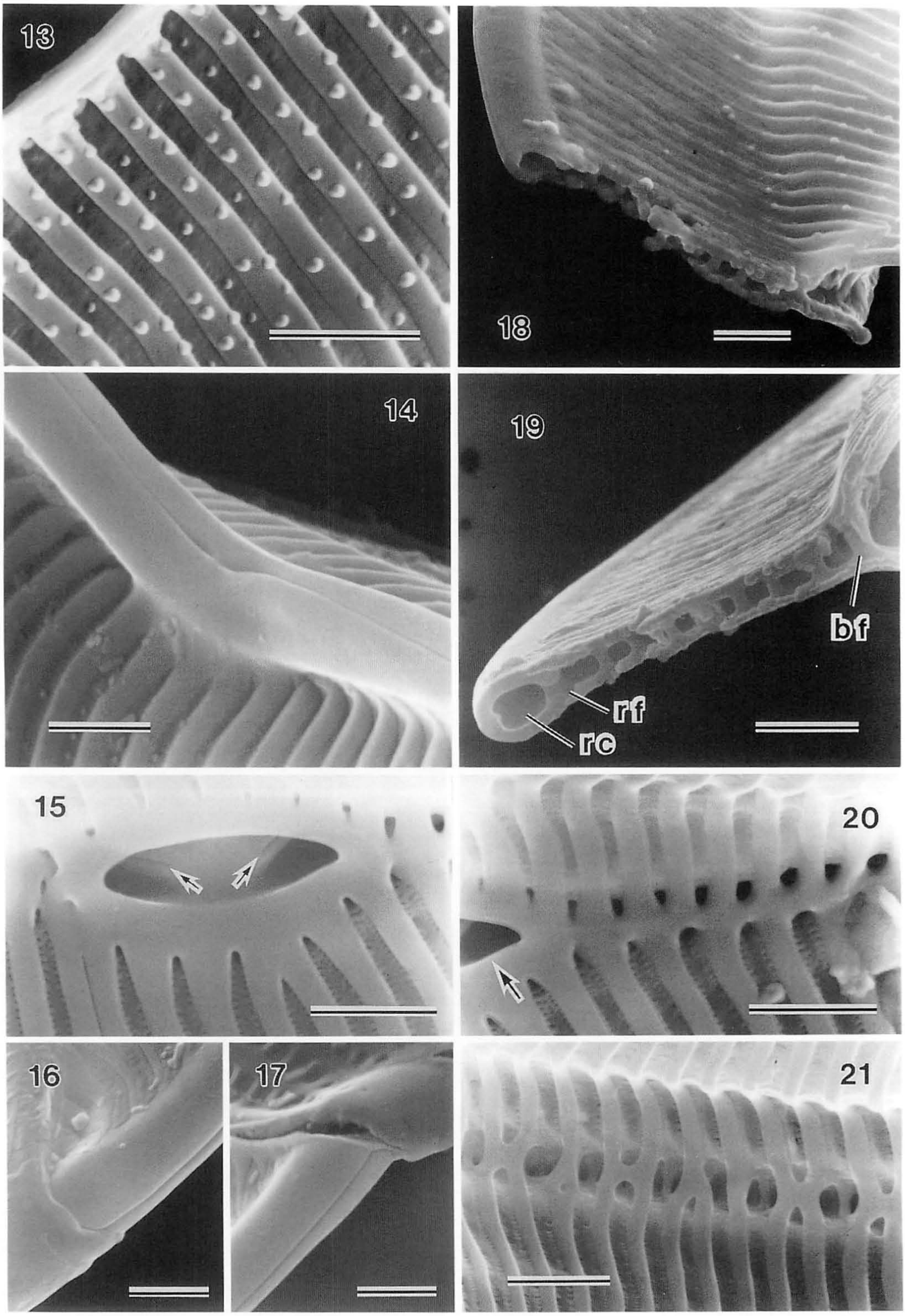

Plate 3.

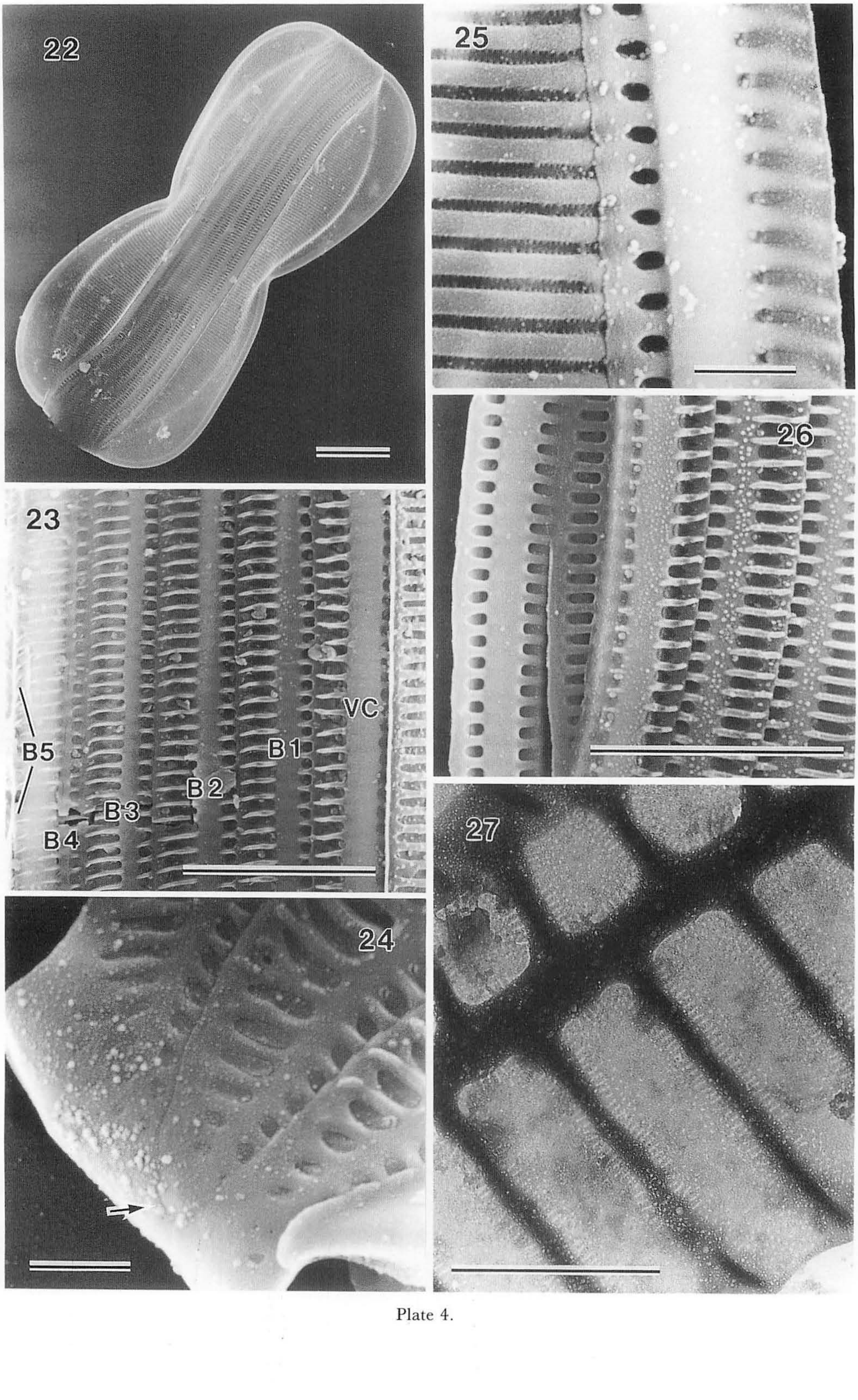

Plate 4.

cavity of the raphe canal. The inmost row of fibulae, the basal fibulae, divides the wing from the valve body (Fig. 19). The neighboring two basal fibulae frequently fuse at their midpoints (Fig. 21). These lateral fusions of the fibulae are continuous and form a fishbone-like structure near the central nodule (Fig. 20). Though the fusion structure is not the same, the fusion of basal fibulae was seen in *E. pseudoduplex* Osada & H. Kob. (1990). It seems that the fusion of basal fibulae is closely related to the forms with decussating wing costae.

The raphe fissure is extremely narrow throughout in comparison with the broad external wall of the raphe canal. Each of the central endings of the raphe fissures terminates in a slightly dilated central pore externally (Fig. 14), but terminates more simply on the inside (Fig. 15). The terminal fissures curve in opposite directions at both ends of a valve (Figs. 16, 17).

The cingulum is composed of at least five to six open bands; one valvocopula and four to five bands. They open and close alternately at each pole of the frustule (Fig. 24) and all have similar structure. Each band has two rows of areolae on the pars exterior and has a smooth edge on the pars interior even in the valvocopula (Figs. 25, 26). The band areolae forming the advalvar row are elliptical or almost circular in the valvocopula, but those of the abvalvar row are elongated (Figs. 23, 26). Each band areola is occluded externally by a hymen with marginal linear perforations arranged in a parallel array (KOBAYASI and NAGUMO 1985) and randomly scattered central ones (Fig. 27). The interareolar costae are markedly raised and numerous warts are on the band surface especially on that be-

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Plate 1. *Entomoneis decussata*. Scale bar = 10 μm.
Fig. 1. Girdle view of valve. Shimabara-wan. OS-381. Fig. 2. Valve view. KE-1554-3. Fig. 3. Girdle view of valve. Yamagata Prefectural Fisheries Experimental Station. OS-425. Fig. 4. Girdle view of a frustule corner. Shimabara-wan. OS-381. TEM. Fig. 5. Frustule in girdle view just before sexual reproduction, 28 μm in length. KE-1554-3. Fig. 6. Frustule attained maximum size just after auxospore formation, 87 μm in length. KE-1554-3.

Plate 2. *Entomoneis decussata*. Shimabara-wan. Scale bars: Figs. 7, 8 = 5 μm, Figs. 9–11 = 1 μm, Fig. 12 = 0.1 μm. Fig. 7. External girdle view of a frustule corner showing the winged keel (wing). The wing costae are arranged obliquely and in parallel slanting toward the valve centre except those arranged radially near the apex. A row of small spines is on the valve costae. Fig. 8. The other corner of the same winged keel as shown in Fig. 7, showing the wing costae all arranged obliquely and in parallel. Fig. 9. Internal valve showing the inner openings of areolae arranged in two rows in each intercosta. Fig. 10. External valve body showing broad valve costae and domed pore occlusions of areolae in each intercosta. Fig. 11. External wing showing the narrow wing costae and elongated pore occlusions with perforations arranged in parallel. Fig. 12. Pore occlusions of areolae on the valve body showing hymenes each with perforations forming lateral lines and arranged in parallel. TEM.

Plate 3. *Entomoneis decussata*. Shimabara-wan. Scale bars = 1 μm.
Fig. 13. External surface of the valve margin showing the small spines on the valve costae and on the intercostae. Fig. 14. Oblique view of the central nodule showing the smooth external surface of the raphe canal elevated from the valve body, and the central raphe endings which terminate in slightly dilated central pores. Fig. 15. Internal view of the central nodule showing the inner opening of the raphe canal, and the central raphe endings which terminate simply (arrows). Figs. 16, 17. Both external apices of the same valve showing terminal fissures curving in opposite directions. Fig. 18. External broken valve showing the smooth surface of the raphe canal and the wing costae. Fig. 19. Broken end of Fig. 18 at a different angle showing the raphe canal (rc), linking fibulae between opposing wing costae, the raphe fibula (rf), and the basal fibula (bf) dividing the valve body and the wing. Fig. 20. Internal valve centre showing the central opening of the raphe canal (arrow), and the basal fibulae centrally fused into a fishbone-like structure. Fig. 21. Internal basal fibulae fused into H or Y shape at location more distal from the valve centre.

Plate 4. *Entomoneis decussata*. Shimabara-wan. Scale bars: Fig. 22 = 10 μm, Figs. 23, 26 = 5 μm, Figs. 24, 25 = 1 μm, Fig. 27 = 0.5 μm. Fig. 22. External girdle view of a whole frustule. Fig. 23. Enlargement of the frustule shown in Fig. 22, showing the epicingulum composed of six bands; one valvocopula (VC), five bands (B1, B2, B3, B4, B5). Fig. 24. Oblique view of one end of the broken theca showing the open end (arrow) of the band between two bands each with a closed apex. Fig. 25. Internal valve margin and a valvocopula with its smooth advalvar edge. The advalvar areolar row of the band is composed of shorter areolae and those of the abvalvar row are composed of more elongated ones. Fig. 26. Advalvar cingulum end showing the internal and external surfaces. Warts are on the external surface of the bands. Fig. 27. Pore occlusions of both the short and the elongate areolae of a band showing linear perforations arranged in parallel near the margins and randomly scattered ones toward the centre. TEM.

tween two areolar rows. The internal surface of the bands is flat (Fig. 26). These features of the cingulum are extremely similar to those of *E. pseudoduplex*, but clearly different from those of *E. alata* var. *japonica*, *E. paludosa* and *E. punctulata* mainly in the presence of the raised interareolar costae. This species seems to be closely related to *E. pseudoduplex*.

The above-mentioned fine structural features are common in both small and large frustules before and after sexual reproduction. Consequently, it is considered that the following features are stable and characteristic of this species: 1) Decussating wing costae with many fibulae: 2) Arcuate junction line formed by the row of basal fibulae fused randomly to each other: 3) Spines on the costae of the valve body: 4) Density of striae, being 22-26 in 10 μm: 5) Perforations arranged in lines in the hymenes which close valve areolae: 6) Externally raised interareolar costae and numerous warts on the surface of the bands.

Nomenclatural treatment

Entomoneis decussata (Grun.) comb. nov.
Basionym: *Amphiprora decussata* Grun. In Cleve and Grunow. Kongl. Sven. Vet. Akad. Handl. **17**(2): 63. 1880.
Synonym: *Amphiprora gigantea* Grun. var. *decussata* (Grun.) Cl. Kongl. Sven. Vet. Akad. Handl. **26**(2): 18. 1894.

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長田敬五*・小林　弘**：海産羽状珪藻 *Entomoneis decussata* (GRUN.) comb. nov. の微細構造

島原湾沿岸および山形県のアワビ養殖場から得た天然個体とクローン培養株に基づいて，*Entomoneis decussata* の微細構造に関する詳細な観察を行った。その結果，本分類群は，1）翼は多くの間板を伴う交差型の肋骨と比較的太い縦溝管を持つ，2）弓形の縫合線は隣同士で時折融合する基部間板の一列によって形成される，3）殻本体は比較的高い密度の条線と肋骨上に多数の小刺を持つ，4）殻の胞紋は1－3本の線状の小孔列を持つ薄皮によって閉塞される，5）各殻帯片の胞紋列の胞紋間肋骨は強く外側に隆起する，などのかなり安定した形質によって特徴づけられることが明かとなった。（*951 新潟市浜浦町1-8　日本歯科大学新潟歯学部生物学教室；**184 東京都小金井市本町3-8-9-813　東京珪藻研究所）

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春・秋に成熟するトゲモクの卵放出，胚発生および光合成速度の季節変化

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HONDA, M. and OKUDA, T. 1990. Egg liberation, germling development and seasonal changes in photosynthetic rates of autumnal *Sargassum micracanthum*. Jpn. J. Phycol. 38: 263-268.

This paper presents the results of studies on egg liberation, germling development and seasonal changes in photosynthetic rates of autumnal *Sargassum micracanthum* from the coast of Tosa, Kochi Pref. In this population, 1) egg liberation does not synchronize with the lunar cycle; 2) egg size varies within a receptacle and also among receptacles in a plant; 3) division of a rhizoid cell is 16-celled type as in the ordinary *S. micracanthum*; and 4) the photosynthetic rate is highest in autumn. The photosynthetic rate of the ordinary vernal *S. micracanthum* from Tsuyazaki, Fukuoka Pref., follows the change in temperature, being highest in summer.

Key Index Words: egg liberation—egg size—Phaeophyceae—photosynthesis—rhizoid—Sargassaceae— Sargassum micracanthum.

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褐藻ホンダワラ類のトゲモク (*Sargassum micracanthum*) は漸深帯上部に生育し，晩冬から春に成熟する種である (YOSHIDA 1983)。本種を対象とした研究のうち成熟に関するものはそれを裏付けるものが多く，神奈川県三崎（猪野1932)，山口県秋穂湾（河本・冨山 1968)，長崎県野母崎（四井ら1984）では5－6月に卵放出が行われている。また福岡県津屋崎 (OKUDA *et al.* 1984) では本種を含む10種で幼胚を用いた実験が4－5月に行われている。一方，土佐湾に生育するものでは成熟期は11-12月と報告されているので(大野1984)，トゲモクには春に成熟するものと秋に成熟するものの2つの個体群が存在することになる。

本研究は，これら両者間の類似点，相違点を明らかにするために行ったもので，さきに報告した（本多・奥田1989)春と秋のアカモクと同様，卵放出，幼胚の発生様式について観察を行い，生長と密接な関係がある光合成速度の季節変化を調べた。

材料と方法

1984年11月22日より12月14日まで，高知県土佐市 (Fig. 1) に生育する秋に成熟するトゲモクの卵放出間隔，放出卵の大きさ，幼胚の発生様式を調べた。光合成速度についてはこのトゲモクと，福岡県津屋崎 (Fig. 1) に生育し春に成熟するトゲモクの両者を調べて比較した。

秋に成熟するトゲモクの卵放出間隔は1日1回のスキューバ潜水により観察した。放出卵の大きさは，高知大学付属海洋生物教育研究センターに持ち帰った藻体を用い，藻体における生殖器床の部位，生殖器床上の放出卵の部位に留意して測定を行った。幼胚の発生様式については持ち帰った母藻を同センターで培養し，観察した。

光合成速度の測定は，土佐の個体群では1984年3，7，9，11月に，津屋崎のものでは1984年2，5，7，9，11月に，それぞれ藻体上部の葉を用いた。土佐で採取した葉は3，9月には約1時間でセンターに，7，11月には1日後に九州大学に持ち帰った。津屋崎で採取した葉は数時間で九州大学に持ち帰った。持ち帰った葉は現地と同水温に保った。光合成速度は2，3月には Winkler 法，他は酸素電極法で測定した。実験には Lyman & Fleming の人工海水を用い，光源には東芝フォトリフレクタランプ（100V 500W フラッド）を用いた。

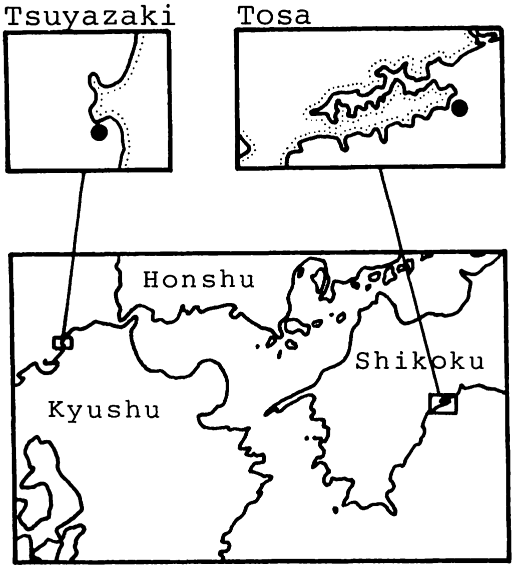

Fig. 1. Maps of sampling stations.

Table 1. Dates of egg liberation in autumnal *Sargassum micracanthum* at Tosa, 1984.

Moon's Phase		●		Nov. 1984				
	22	23	24	25	26	27	28	29
	⊛				⊙	⊛		
Moon's Phase	◐		Dec.					
	30	1	2	3	4	5	6	7
			⊛					
Moon's Phase	○							
	8	9	10	11	12	13	14	
						⊛		

⊙: A small number of eggs liberated.

⊛: A large number of eggs liberated.

実験の光条件は2月は 0, 170, 500, 1000, 2000 μE・m^{-2}・sec^{-1} の5段階，3月は 0, 180, 550, 1000, 2000 μE・m^{-2}・sec^{-1} の5段階，5月は 0, 300, 500, 1000, 1500, 2000 μE・m^{-2}・sec^{-1} の6段階，7，9，11月は 0, 140, 200, 300, 500, 1000, 1500 μE・m^{-2}・sec^{-1} の7段階であった。温度条件は秋に成熟するトゲモクでは3月 15°C，7月 25°C，9月 25°C，11月 20°C であり，生育場所の水温はそれぞれ 15, 23.5, 26, 20.9°C であった。春に成熟するトゲモクでは2月 10°C，5月 20°C, 7月 30°C, 9月 25°C, 11月 20°C であり，生育場所の水温はそれぞれ 10.2, 19.8, 28.8, 26, 20.1°C であった。

結　果

卵放出

卵放出日を Table 1 に示す。卵放出は11月22，26，27日，12月2，13日に見られた。但し11月26日にはごく僅かの個体で放出卵が見られたに過ぎなかった。放出間隔は主に5日と11日で，太陰周期との関係は認められなかった。水深の浅いところに生育する個体も深いところに生育する個体も同じ日に卵放出した。生殖器床上の幼胚の残留日数は2日から3日であった。1回目の卵放出が生殖器床の2/3以上の範囲で行われるものが多く，2回目以降の放出卵は相対的に少なかった。

放出卵の大きさは中部で大きく，藻体の上部，生殖器床の先端部側で小さくなる傾向が認められた (Table 2)。同様の傾向は津屋崎の春に成熟するトゲモクでも認められた (Table 3)。

幼胚の発生様式

秋に成熟するトゲモク幼胚の発生様式を Fig. 2 に示す。放出卵は8核を有し (Fig. 2a)，受精後1核のみ残し他の核は消える。第一分割は長軸に対して垂直に起こり (Fig. 2b)，第二分割でレンズ状の仮根細胞が形成される (Fig. 2c)。この仮根細胞は4回の引続いて行わ

Fig. 2. Germling development of autumnal *Sargassum micracanthum* at Tosa. a, egg with 8 nuclei; b, first segmentation; c, second segmentation, forming a rhizoid cell; d, first segmentation of the rhizoid cell; e, second segmentation of the rhizoid cell; f, third segmentation of the rhizoid cell; g, rhizoid cell in a 16-celled stage; h & i, rhizoids somewhat elongated; j, rhizoids further elongated; k, rhizoids ramified.

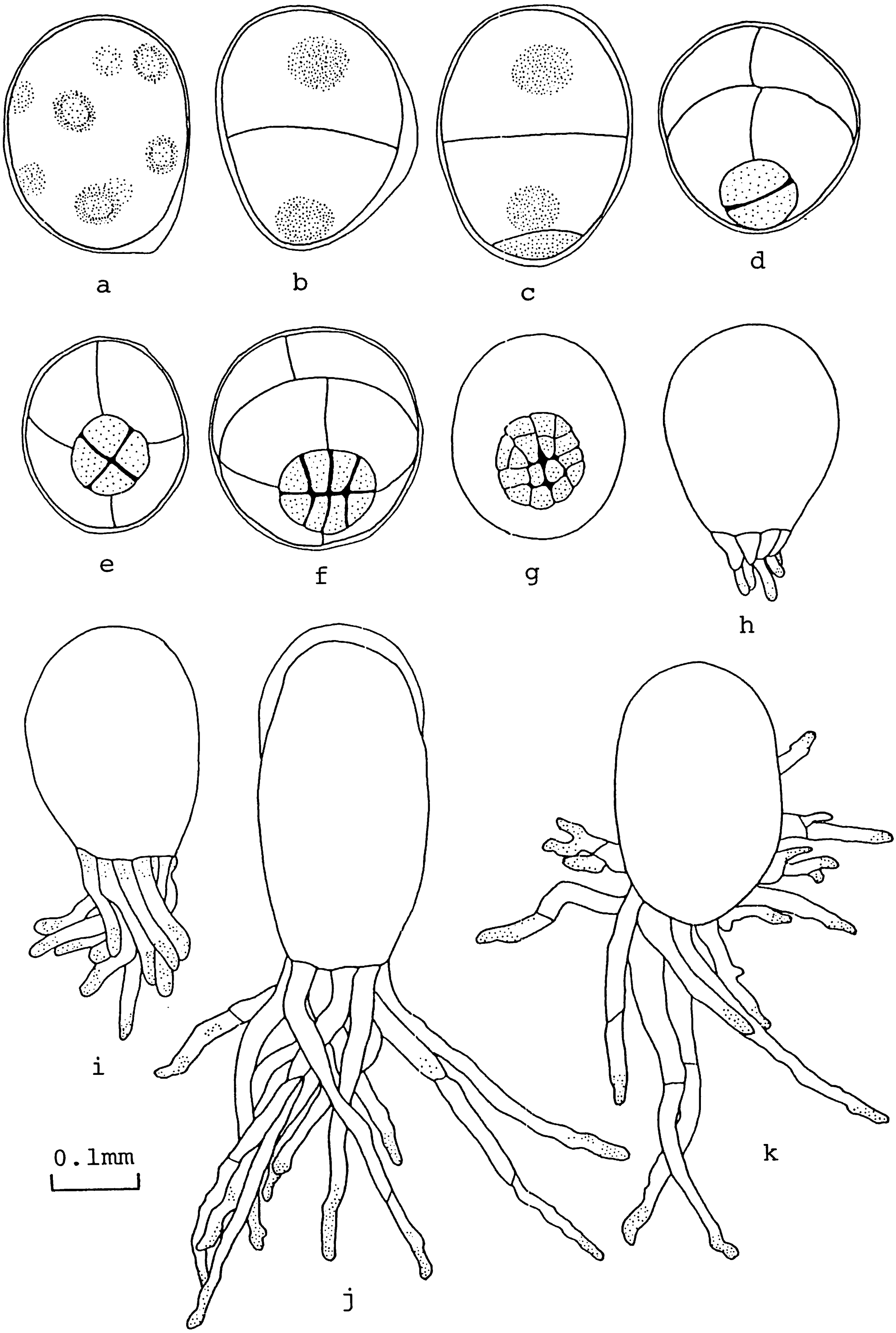
a
b
c
d
e
f
g
h
i
j
k
0.1mm

Table 2. Egg size in mean value (μm) for autumnal *Sargassum micracanthum* at Tosa.

		Position in one receptacle		
		Basal		Upper
Position in one plant	Upper	229 X 170	>	216 X 179
		∧		∧
	Middle	257 X 199	>	246 X 194
		‖		‖
	Basal	252 X 192	>	243 X 188

‖ : Differrence is not significant (P<0.05).
∧,> : Difference is significant (P<0.05).

Table 3. Egg size in mean value (μm) for *Sargassum micracanthum* at Tsuyazaki.

		Position in one receptacle		
		Basal		Upper
Position in one plant	Upper	217 X 171	>	209 X 161
				∧
	Middle			235 X 179
				∨
	Basal	245 X 180	>	217 X 165

∨,∧,> : Difference is significant (P<0.05).

れる細胞分裂で16の細胞に分割される (Fig. 2d, e, f, g)。その後それぞれの細胞から1本ずつ計16本の仮根が伸長する (Fig. 2h, i, j)。仮根は受精後約6日で枝分かれを始め，付着面を増大する (Fig. 2k)。

光合成速度の季節変化

津屋崎の春に成熟するトゲモクの2，5，7，9，11月の単位面積当りの純光合成速度に基づいて作成した光–光合成曲線を Fig. 3 に示す。2月には純光合成速度は 170 $\mu E \cdot m^{-2} \cdot sec^{-1}$ で光飽和に達しており，その値は 1.32 $\mu mol O_2 \cdot cm^{-2} \cdot hr^{-1}$ であった。成熟期盛期の5月には 500 $\mu E \cdot m^{-2} \cdot sec^{-1}$ でほぼ光飽和に達しており，その値は 0.71 $\mu mol O_2 \cdot cm^{-2} \cdot hr^{-1}$ であった。7月には 500 $\mu E \cdot m^{-2} \cdot sec^{-1}$ で光飽和に達しており，その値は 4.83 $\mu mol O_2 \cdot cm^{-2} \cdot hr^{-1}$ であった。Ik 値は約 440 $\mu E \cdot m^{-2} \cdot sec^{-1}$ となった。9月には 500 $\mu E \cdot m^{-2} \cdot sec^{-1}$ で光飽和に達しており，その値は 3.92 $\mu mol O_2 \cdot cm^{-2} \cdot hr^{-1}$, Ik 値は約 400 $\mu E \cdot m^{-2} \cdot sec^{-1}$ となった。

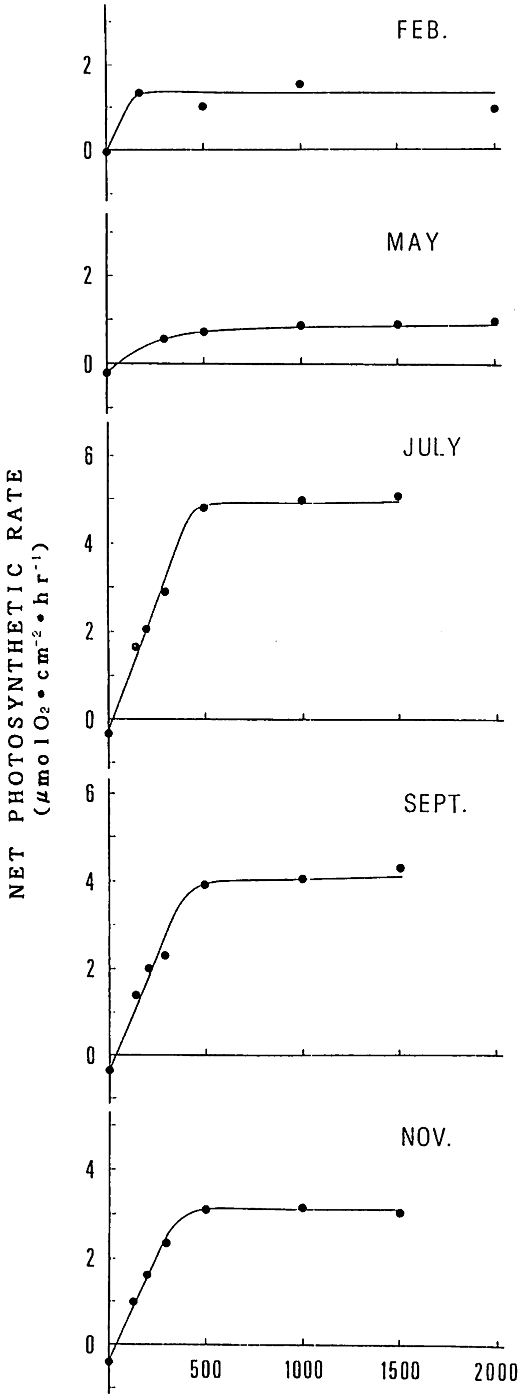

Fig. 3. Seasonal changes in photosynthesis-light relationships of *Sargassum micracanthum* at Tsuyazaki.

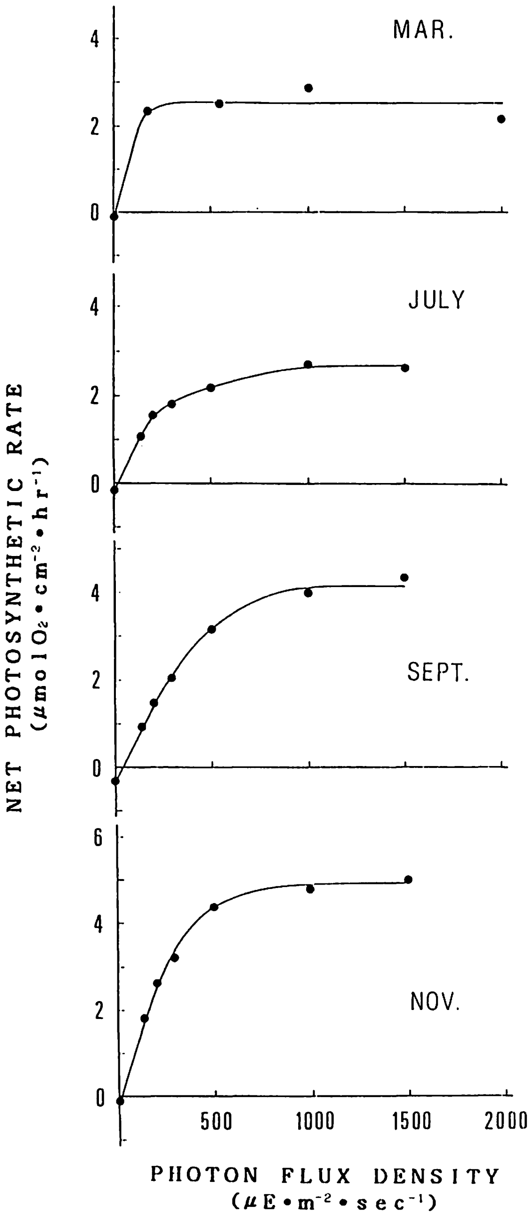

Fig. 4. Seasonal changes in photosynthesis-light relationships of autumnal *Sargassum micracanthum* at Tosa.

11月には 500 μE$\cdot$m$^{-2}\cdot$sec^{-1} で光飽和に達しており，その値は 3.08 μmol$O_2\cdot$cm$^{-2}\cdot$hr^{-1}，Ik 値は約 340 μE$\cdot$m$^{-2}\cdot$sec^{-1} となった。

土佐の秋に成熟するトゲモクの3，7，9，11月の単位面積当りの純光合成速度に基づき作成した光−光合成曲線を Fig. 4 に示す。3月には純光合成速度は 180 μE$\cdot$m$^{-2}\cdot$sec^{-1} で光飽和に達しており，その値は 2.30 μmol$O_2\cdot$cm$^{-2}\cdot$hr^{-1} であった。7月には 1000 μE$\cdot$m$^{-2}\cdot$sec^{-1} で光飽和に達しており，その値は 2.69 μmol $O_2\cdot$cm$^{-2}\cdot$hr^{-1}, Ik 値は約 330 μE$\cdot$m$^{-2}\cdot$sec^{-1} となった。9月には 1000 μE$\cdot$m$^{-2}\cdot$sec^{-1} でほぼ光飽和に達しており，その値は 3.98 μmol$O_2\cdot$cm$^{-2}\cdot$hr^{-1}，Ik 値は約 520 μE$\cdot$m$^{-2}\cdot$sec^{-1} となった。11月には 1000 μE$\cdot$m$^{-2}\cdot$sec^{-1} でほぼ光飽和に達しており，その値は 4.76 μmol $O_2\cdot$cm$^{-2}\cdot$hr^{-1}, Ik 値は約 360 μE$\cdot$m$^{-2}\cdot$sec^{-1} となった。

考　察

河本・冨山（1968)は山口県秋穂湾のトゲモクの卵放出時期の水温は約 15–23°C であると報告している。今回，津屋崎での卵放出時期の水温は 15–20°C 程度であった。今回，土佐の秋に成熟するトゲモクの卵放出時期の水温は約 20°C であり，春に成熟期を持つトゲモクと同水温範囲にあった。

ホンダワラ類の卵放出は大潮時に起こることが多く報告されている（猪野1939，須藤1948，Fletcher 1980)。しかし Okuda (1981) や四井ら（1984)は必ずしも大潮時とは限らず，むしろ潮汐周期との関係は認められないことを示している。河本・冨山（1968)も山口県秋穂湾では一般的には大潮時としながらも，小潮時に卵放出があったことも述べている。土佐の秋に成熟するトゲモクの卵放出間隔は5日と11日，および一部の個体では4日であり，強い同時性は認められたものの潮汐との関係はなかった。奥田（1982)は津屋崎の春に成熟するトゲモクにおいて卵放出間隔は6日から9日で，その中でも7日間隔の頻度が高いと報告している。卵放出の潮汐の影響について考察するためにはさらに異なる多くの場所での観察が必要であろう。

猪野（1947)は卵の大きさは各属各種で一定しており，一般に体制の複雑な，分類学的に上位にあるものほど大きいと述べている。トゲモクについては三崎で5月から7月に得た放出卵の大きさを 384×275 μm としているが，この値は今回報告した土佐および津屋崎のものに比べて非常に大きい。1個体内，また1生殖器床内でも差のあることから，今後大きさの比較を行う場合にはこのような条件も考慮することが必要と思われる。

秋に成熟するトゲモクの仮根細胞は十六細胞型に分裂し，16本の仮根が伸長する点，猪野（1947)の報告するトゲモクと同じであった。

春に成熟するトゲモクの光合成の光飽和点および Ik 値は冬季に低く，夏季に高かった。純光合成速度

は成熟期の5月を除いてIk値が高くなるほど高くなっており，現場水温が最も高かった7月に最高となった。秋に成熟するトゲモクでは冬季には光合成の光飽和点が下がり，高水温期に光飽和点およびIk値が高いのは同様であった。しかし11月には光-光合成曲線の立ち上がり勾配が大きいためIk値が9月より低いにも拘らず純光合成速度は最高となり，春に成熟するトゲモクの光合成活性の季節変化とは異なる型を示した。土佐湾の秋に成熟するトゲモクについて大野(1984)は3月は主枝長が短くなり，5月から7月にかけて最も短く，その後伸長すると報告しており，今回の光合成活性の季節変化の結果はその成長のパターンと適合している。植物は生殖成長に移行するまでに一定量以上の栄養成長を達成しなければならず，成長は光合成に依存する。ホンダワラ類のように季節的消長の著しい海藻において，光合成活性の季節変化の違いは生殖成長に移行できるだけの栄養成長を達成する時期に大きな影響を与える。秋に成熟するトゲモクは，その光合成能の季節変化のパターンゆえに，水温が成熟期と同程度（約20°C）の春季には藻体は小さく，生殖成長への移行に充分な栄養成長を達成することができない。このため春に成熟するトゲモクとは異なる個体群を形成すると考えられる。

謝　　辞

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吉田忠生*・中嶋　泰**・中田由和**： **日本産海藻目録（1990年改訂版）**

Tadao YOSHIDA, Yasushi NAKAJIMA and Yoshikazu NAKATA: Check-list of marine algae of Japan (revised in 1990).

1985年に私達は「日本産海藻目録」を予備的なものとして纏めた。その際，将来これを改訂して更に確実なものとしたいと述べた。「目録」は多くの方々に利用され，また様々なご指摘も頂いた。またこの5年間にも多数の研究成果が発表され，「目録」を改訂すべき時期になったと考えた。

目録の編集方針は前回と同様である。すなわち，

- 南は与那国島・小笠原島から北は北海道までの現在の日本の行政範囲で記録された種に限る。
- 目までの分類体系は緑藻については千原（1979）に，褐藻については CLAYTON（1988）に，紅藻はダルス目 Palmariales とサイミ目 Ahnfeltiales を認めた以外はおおむね KYLIN (1956) に従った。科と属，種の配列は Alphabet 順とした。
- 属名の綴りと属の所属すべき科についてはおおむね Index Nominum Genericorum (FARR *et al.* 1979, 1986) に従った。その他最近の決定によって正しいものを用いた。
- 種小名はすべて小文字とし，その語尾は規約に従って改めてある。種以下の分類群が認められている場合，イワズタ属など一部を除きノートとして加えた。
- 学名の著者引用はできるだけ詳しくしたので，利用の際には必要に応じて一部を省略してもよい。すなわち ex で組み合わされた名前はその前の名前，in で結びつけられた名前はその後のものを省略してもよい。更に簡単にするときにはカッコ内の名前を省く。また著者名も有名で他と混同がない場合は習慣的な略し方をしてもよい。
- 異名 synonym は日本海藻誌などに用いられている主なものと前回の「目録」で採用していたものを[ ]に入れて示した。
- 種の和名はここで新しく附けることはせず，すでに発表されたものを採用した。種が纏められたために和名が2つ以上になった場合，できるだけ1つを用いるようにした。属以上の分類群については代表的な種の名前からつけたり，学名のカナ書きとした。
- 注記の必要な場合は，名前のあとにカッコ附きの番号で示し，目録の後に列記した。
- 今回の目録で新しく付け加えられた種には種小名の前に＊をつけて示した。
- 目録中で使用されている略語は次の通りである。

auct. japon.＝auctorum japonicorum　日本の多くの著者によって習慣的に用いられてきた。

frat.＝frater　兄弟。

nom. cons.＝nomen conservandum　より古い名前に対して保留が認められて国際植物命名規約附録Ⅱ，Ⅲに収録されている名前，保留名。

orth. cons.＝orthographia conservanda　もとの綴りと違うものが慣用により一般化し，保留が認められたもの。

sensu　ある著者が同定の誤りなどにより用いた名前。

この目録の改訂には多くの方々のご指摘やご意見を頂いた。とくに紅藻については北海道大学正置富太郎名誉教授，北海道大学理学部増田道夫博士に，褐藻に関しては北海道大学理学部川井浩史博士に，緑藻について琉球大学香村真徳教授にご意見を頂いた。厚くお礼申し上げる。また，この目録は将来さらに改訂されるべきもので，ご意見，ご指摘を頂ければ幸いである。

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CHLOROPHYCEAE WILLE in WARMING, 1884 緑藻綱 (ULVOPHYCEAE STEWART et MATTOX, 1978)

CHLOROSPHAERALES HERNDON, 1958 クロロスファエラ目

Collinsiellaceae CHIHARA, 1967　らんそうもどき科 (1)

Collinsiella SETCHELL et GARDNER, 1903　らんそうもどき属

cava (YENDO) PRINTZ　しわらんそうもどき

japonica (YENDO) PRINTZ　こつぶらんそうもどき

tuberculata SETCHELL et GARDNER　らんそうもどき

Collinsiellopsis CHIHARA, 1967　にせらんそうもどき属

expansa CHIHARA にせらんそうもどき

CHLOROCOCCALES PASCHER, 1915 クロロコックム目

Endosphaeraceae (KLEBS) ARTARI, 1892 エンドスファエラ科

Chlorochytrium COHN, 1872 クロロキトリウム属 (2)

porphyrae SETCHELL et GARDNER

Codiolum A. BRAUN, 1855 コディオルム属

gregarium A. BRAUN

Gomontia BORNET et FLAHAULT, 1888 かいみどり属

polyrhiza (LAGERHEIM) BORNET et FLAHAULT かいみどり

Palmellaceae DECAISNE, 1842 パルメラ科

Palmophyllum KÜTZING, 1847 パルモフィルム属 (3)

crassum (NACCARI) RABENHORST

var. *orbiculare* (BORNET) FELDMANN

[*orbiculare*]

ULOTRICHALES BORZI, 1895 ひびみどろ目

Ulotrichaceae KÜTZING, 1843 ひびみどろ科

Ulothrix KÜTZING, 1833 ひびみどろ属

flacca (DILLWYN) THURET in LE JOLIS ひびみどろ (4)

[*pseudoflacca* WILLE ほそひびみどろ]

flexuosa KORNMANN

implexa (KÜTZING) KÜTZING (4)

[*acrorhiza* KORNMANN]

CHAETOPHORALES WILLE, 1901 カエトフォラ目

Chaetophoraceae GREVILLE, 1824 カエトフォラ科 (たまも科)

Bolbocoleon PRINGSHEIM, 1862 ボルボコレオン属

* *piliferum* PRINGSHEIM (5)

Entocladia REINKE, 1879 エントクラディア属

cladophorae NODA しおぐさのいとも

hypoglossiae NODA ないせいいとも

polysiphoniae SETCHELL et GARDNER いとも

Internoretia SETCHELL et GARDNER, 1920 インテルノレティア属 (6)

fryeana SETCHELL et GARDNER

Ulvella CROUAN frat., 1859 あわびも属 (7)

lens CROUAN frat. あわびも

ULVALES BLACKMANN et TANSLEY, 1902 あおさ目

Capsosiphonaceae CHAPMAN, 1952 かぶさあおのり科

Capsosiphon GOBI, 1879 かぶさあおのり属

fulvescens (C. AGARDH) SETCHELL et GARDNER かぶさあおのり

groenlandicus (J. AGARDH) VINOGRADOVA ひもひとえぐさ

[*Monostroma groenlandica*]

Kornmanniaceae GOLDEN et COLE, 1986 もつきひとえぐさ科

Kornmannia BLIDING, 1969 もつきひとえ属

leptoderma (KJELLMAN) BLIDING もつきひとえ (8)

[*zostericola*]

[*Monostroma zostericola*]

Monostromataceae KUNIEDA, 1934 ひとえぐさ科

Monostroma THURET, 1854 ひとえぐさ属

alittoralis TANAKA et K. NOZAWA in TANAKA しんかいひとえぐさ

angicava KJELLMAN えぞひとえぐさ

arcticum WITTROCK きたひとえぐさ

crassidermum TOKIDA あつかわひとえ

crassissimum IWAMOTO あつばひとえ

grevillei (THURET) WITTROCK うすひとえぐさ

latissimum WITTROCK ひろはのひとえぐさ

nitidum WITTROCK ひとえぐさ

oxyspermum (KÜTZING) DOTY まきひとえ

[*wittrockii*]

tubiforme IWAMOTO らっぱひとえ

Protomonostroma VINOGRADOVA, 1969 しわひとえぐさ属

undulatum (WITTROCK) VINOGRADOVA しわひとえぐさ

[*Monostroma undulatum*]

Prasiolaceae BLACKMAN et TANSLEY, 1902 かわのり科

Prasiola (C. AGARDH) MENEGHINI, 1836 nom. cons. かわのり属

delicata SETCHELL et GARDNER ひめいそかわのり

Ulvaceae LAMOUROUX ex DUMORTIER, 1822 あおさ

科

Blidingia KYLIN, 1947 ひめあおのり属

minima (NÄGELI in KÜTZING) KYLIN ひめあおのり

[*Enteromorpha nana* var. *minima*]

[*Enteromorpha micrococca*]

Enteromorpha LINK in NEES, 1820 nom. cons. あおのり属 (9)

capillaris NODA in NODA et KITAMI いとあおのり

clathrata (ROTH) GREVILLE

compressa (LINNAEUS) NEES ひらあおのり

crinita (ROTH) NEES ほそえだあおのり

flexuosa (WULFEN) J. AGARDH

intestinalis (LINNAEUS) NEES ぼうあおのり

linza (LINNAEUS) J. AGARDH うすばあおのり

[*bulbosa* var. *japonica*]

marginata J. AGARDH

plumosa KÜTZING きぬいとあおのり（わたげあおのり）

prolifera (MÜLLER) J. AGARDH すじあおのり

ramulosa (SMITH) CARMICHAEL in HOOKER ひげあおのり

Percursaria BORY, 1823 ペルクルサリア属

percursa (C. AGARDH) ROSENVINGE

Ulva LINNAEUS, 1753 nom. cons. あおさ属

amamiensis TANAKA うしゅくあおさ

arasakii CHIHARA ながあおさ

conglobata KJELLMAN ぼたんあおさ (10)

fasciata DELILE りぼんあおさ

fenestrata POSTELS et RUPRECHT (11)

japonica (HOLMES) PAPENFUSS やぶれぐさ

[*Letterstedtia japonica*]

latissima LINNAEUS おおばあおさ

pertusa KJELLMAN あなあおさ

reticulata FORSSKÅL あみあおさ

rigida C. AGARDH (11)

spinulosa OKAMURA et SEGAWA in SEGAWA

sublittoralis SEGAWA おおあおさ

Ulvaria RUPRECHT, 1850 くろひとえぐさ属

obscura (KÜTZING) GAYRAL

var. *blyttii* (ARESCHOUG) BLIDING くろひとえぐさ

[*Monostroma fuscum*]

[*Monostroma splendens* おおひとえぐさ]

ACROSIPHONIALES KORNMANN, 1965 もつれぐさ目

Acrosiphoniaceae JÓNSSON, 1959 もつれぐさ科

Spongomorpha KÜTZING, 1843 もつれぐさ属 (12)

duriuscula (RUPRECHT) COLLINS もつれぐさ (13, 14)

[*breviarticulata* きたみもつれぐさ]

heterocladia SAKAI いぶりもつれぐさ (13)

[*mertensii* f. *tenuis* ほそもつれぐさ]

mertensii SETCHELL et GARDNER かぎもつれぐさ (13)

saxatilis (RUPRECHT) COLLINS とげなしもつれぐさ (15)

spiralis SAKAI うずもつれぐさ (13)

Urospora ARESCHOUG, 1866 nom. cons. しりおみどろ属 (16)

penicilliformis (ROTH) ARESCHOUG しりおみどろ

[*mirabilis*]

wormskioldii (MERTENS in HORNEMANN) ROSENVINGE おおしりおみどろ

CLADOPHORALES HÄCKEL, 1894 しおぐさ目

Anadyomenaceae KÜTZING, 1843 うきおりそう科

Anadyomene LAMOUROUX, 1812 orth. cons. うきおりそう属

wrightii HARVEY in GRAY うきおりそう

Microdictyon DECAISNE, 1841 あみもよう属

japonicum SETCHELL あみもよう

nigrescens (YAMADA) SETCHELL くろあみもよう

okamurae SETCHELL たのもぐさ

vanbosseae SETCHELL しぼりあみもよう

Valoniopsis BØRGESEN, 1934 ほそばろにあ属

pachynema (MARTENS) BØRGESEN ほそばろにあ

Willeella BØRGESEN, 1930 ひらしおぐさ属 (17)

japonica YAMADA et SEGAWA in SEGAWA ひらしおぐさ

Cladophoraceae WILLE in WARMING, 1884 nom. cons. しおぐさ科

Chaetomorpha KÜTZING, 1845 nom. cons. じゅずも属 (18)

aerea (DILLWYN) KÜTZING たるがたじゅずも

antennina (BORY) KÜTZING えながじゅずも

[*media*]

basiretrorsa SETCHELL ちゃぼじゅずも

brachygona HARVEY

crassa (C. AGARDH) KÜTZING ほそじゅずも

gracilis KÜTZING わたじゅずも

linum (MÜLLER) KÜTZING うすいろじゅずも（わら

くずも)
melagonium (WEBER et MOHR) KÜTZING はりがねじゅずも
moniligera KJELLMAN たまじゅずも
pachynema (MONTAGNE) KÜTZING ぼうじゅずも
spiralis OKAMURA ふとじゅずも
Cladophora KÜTZING, 1843 nom. cons. しおぐさ属
albida (NEES) KÜTZING わたしおぐさ
aokii YAMADA あおきしおぐさ
arenaria SAKAI すなしおぐさ
catenata (LINNAEUS) KÜTZING かびしおぐさ
[*fuliginosa*]
conchopheria SAKAI かいごろも
fascicularis (MERTENS ex C. AGARDH) KÜTZING ふさしおぐさ
glomerata (LINNAEUS) KÜTZING かもじしおぐさ
gracilis KÜTZING なよしおぐさ
japonica YAMADA おおしおぐさ
meridionalis SAKAI et YOSHIDA in YOSHIDA みなみしおぐさ
[*patula* SAKAI]
ohkuboana HOLMES かたしおぐさ
oligoclada HARVEY さいだしおぐさ
opaca SAKAI つやなししおぐさ(はいいろしおぐさ)
[*glaucescens* auct. japon.]
ordinata (BØRGESEN) HOEK なんかいひらしおぐさ
[*Willeella ordinata*]
pusilla SAKAI こしおぐさ
rudolphiana (C. AGARDH) KÜTZING たまりしおぐさ (19)
rugulosa MARTENS くろしおぐさ
rupestris (LINNAEUS) KÜTZING いわしおぐさ
ryukyuensis SAKAI et YOSHIDA in YOSHIDA ちゃぼしおぐさ
[*fastigiata* HARVEY]
sakaii ABBOTT あさみどりしおぐさ
[*densa* HARVEY]
sibogae REINBOLD ねだししおぐさ
speciosa SAKAI みやびしおぐさ
stimpsonii HARVEY きぬしおぐさ
uncinella HARVEY まきしおぐさ
wrightiana HARVEY ちゃしおぐさ
Rhizoclonium KÜTZING, 1843 ねだしぐさ属
grande BØRGESEN おおねだしぐさ
hookeri KÜTZING おきなわねだしぐさ
implexum (DILLWYN) KÜTZING かわぐちみどろ (20)
[*kerneri*]
[*kochianum* びろうどみどろ]
riparium (ROTH) KÜTZING ex HARVEY ほそねだしぐさ
[*arenosum*]
tortuosum (DILLWYN) KÜTZING ながもつれ

SIPHONOCLADALES (BLACKMAN et TANSLEY) OLTMANNS, 1904 みどりげ目

Boodleaceae BØRGESEN, 1925 あおもぐさ科
Boodlea MURRAY et DE TONI, 1889 あおもぐさ属
coacta (DICKIE) MURRAY et DE TONI in MURRAY あおもぐさ
composita (HARVEY et HOOKER) BRAND はねあおもぐさ
[*siamensis* ゆるあおもぐさ]
Struvea SONDER, 1845 nom. cons. あみは属
anastomosans (HARVEY) PICCONE et GRUNOW in PICCONE さいのめあみは
[*delicatula*]
haterumensis ITONO ひめあみは
japonica OKAMURA et SEGAWA in SEGAWA まるあみは
orientalis A. et E. S. GEPP おおあみは
tenuis ZANARDINI あみは

Siphonocladaceae SCHMITZ, 1879 nom. cons. まがたまも科
Boergesenia J. FELDMANN, 1938 まがたまも属
forbesii (HARVEY) FELDMANN まがたまも
[*Valonia forbesii*]
Chamaedoris MONTAGNE, 1842 たんぽやり属
orientalis OKAMURA et HIGASHI in OKAMURA たんぽやり
Cladophoropsis BØRGESEN, 1905 nom. cons. みどりげ属
* *corallinicola* KAJIMURA (21)
herpestica (MONTAGNE) HOWE かたばみどりげ
sundanensis REINBOLD ひめみどりげ
vaucheriaeformis (ARESCHOUG) PAPENFUSS きつねのお
[*Spongocladia vaucheriaeformis*]
zollingeri (KÜTZING) REINBOLD みどりげ
[*fasciculatus*]
Siphonocladus SCHMITZ, 1879 くだねだしぐさ属
tropicus J. AGARDH くだねだしぐさ

Valoniaceae KÜTZING, 1849 ばろにあ科

Dictyosphaeria DECAISNE ex ENDLICHER, 1843 きっこうぐさ属

cavernosa (FORSSKÅL) BØRGESEN きっこうぐさ

[*fabulosa*]

versluysii WEBER VAN BOSSE むくきっこうぐさ

[*bokotensis* とげきっこうぐさ]

Valonia C. AGARDH, 1822 ばろにあ属

aegagropila C. AGARDH たまばろにあ

fastigiata HARVEY ex J. AGARDH

macrophysa KÜTZING たまごばろにあ

oblongata J. AGARDH (22)

utricularis (ROTH) C. AGARDH ばろにあ

Ventricaria OLSEN et WEST, 1988 おおばろにあ属 (23)

ventricosa (J. AGARDH) OLSEN et WEST おおばろにあ

[*Valonia ventricosa*]

DASYCLADALES PASCHER, 1931 かさのり目

Dasycladaceae KÜTZNIG, 1843 かさのり科

Acetabularia LAMOUROUX, 1821 nom. cons. かさのり属 (24)

caliculus LAMOUROUX in QUOY et GAIMARD ほそえがさ

[*calyculus*]

clavata YAMADA はなれがさ

dentata SOLMS-LAUBACH りゅうきゅうがさ

exigua SOLMS-LAUBACH ほしがたかさのり

parvula SOLMS-LAUBACH ひなかさのり（うすゆきがさ）

[*moebii*]

ryukyuensis OKAMURA et YAMADA in OKAMURA かさのり

Bornetella MUNIER-CHALMAS, 1877 みずたま属

clavellina TANAKA ほそみずたま

nitida MUNIER-CHALMAS ex SONDER ながみずたま

oligospora SOLMS-LAUBACH

sphaerica (ZANARDINI) SOLMS-LAUBACH みずたま

[*ovalis*]

Cymopolia LAMOUROUX, 1816 うすがさね属

van-bosseae SOLMS-LAUBACH うすがさね

Halicoryne HARVEY, 1859 いそすぎな属

wrightii HARVEY いそすぎな

Neomeris LAMOUROUX, 1816 ふでのほ属

annulata DICKIE ふでのほ

mucosa HOWE ぬれふでのほ

vanbosseae HOWE こなはだふでのほ

CODIALES FELDMANN, 1954 みる目

Bryopsidaceae BORY, 1829 はねも科

Bryopsis LAMOUROUX, 1809 はねも属 (25)

corticulans SETCHELL ねざしはねも

corymbosa J. AGARDH ふさはねも

harveyana J. AGARDH かたはのはねも

hypnoides LAMOUROUX おばなはねも

indica A. et E. S. GEPP いんどはねも

maxima OKAMURA おおはねも

muscosa LAMOUROUX ながほのはねも

plumosa (HUDSON) C. AGARDH はねも (26)

ryukyuensis YAMADA わたはねも

Pseudobryopsis BERTHOLD in OLTMANNS, 1904 にせはねも属 (27)

hainanensis TSENG はねももどき

[*myura* sensu YENDO]

Caulerpaceae KÜTZING, 1843 いわづた科

Caulerpa LAMOUROUX, 1809 いわづた属

ambigua OKAMURA ひめいわづた

brachypus HARVEY へらいわづた

cupressoides (VAHL) C. AGARDH

var. *cupressoides* びゃくしんづた

var. *lycopodium* WEBER VAN BOSSE

f. *amicorum* (HARVEY) WEBER VAN BOSSE

f. *disticha* WEBER VAN BOSSE

f. *elegans* WEBER VAN BOSSE うつくしづた

fastigiata MONTAGNE けいわづた

fergusonii MURRAY ふじのはづた

filicoides YAMADA ひめしだづた

[*verticillata* f. *acuta*]

lentillifera J. AGARDH くびれづた

nummularia HARVEY ex J. AGARDH すずかけづた

[*peltata* var. *nummularia*]

okamurae WEBER VAN BOSSE in OKAMURA (28)

f. *okamurae* ふさいわづた

f. *oligophylla* OKAMURA

[*tateyamaensis* YENDO]

parvifolia HARVEY ひないわづた

[*brachypus* f. *parvifolia*]

racemosa (FORSSKÅL) J. AGARDH (29)

var. *clavifera* (TURNER) WEBER VAN BOSSE

f. *macrophysa* (KÜTZING) WEBER VAN BOSSE せん

なりづた
f. *microphysa* WEBER VAN BOSSE こつぶせんなりづた
f. *reducta* BØRGESEN
var. *laete-virens* (MONTAGNE) WEBER VAN BOSSE すりこぎづた
var. *lamourouxii* (TURNER) WEBER VAN BOSSE ひらえづた
var. *occidentalis* (J. AGARDH) BØRGESEN えつきづた
var. *peltata* (LAMOUROUX) EUBANK たかつきづた
[*peltata*]
var. *uvifera* (C. AGARDH) J. AGARDH こはぎづた
scalpelliformis (R. BROWN ex TURNER) C. AGARDH
var. *denticulata* (DECAISNE) WEBER VAN BOSSE あまみのくろきづた (30)
var. *intermedia* WEBER VAN BOSSE くろきづた
serrulata (FORSSKÅL) J. AGARDH
var. *serrulata*
f. *lata* (WEBER VAN BOSSE) TSENG よれづた
var. *boryana* (J. AGARDH) YAMADA et TANAKA
f. *occidentalis* (WEBER VAN BOSSE) YAMADA et TANAKA さいはいづた
sertularioides (GMELIN) HOWE
f. *longipes* (J. AGARDH) COLLINS たかのはづた
subserrata OKAMURA きざみづた
taxifolia (VAHL) C. AGARDH いちいづた
verticillata J. AGARDH
f. *charoides* (HARVEY) WEBER VAN BOSSE うちわづた
webbiana MONTAGNE
f. *disticha* WEBER VAN BOSSE
f. *elegans* YAMADA et TANAKA
f. *tomentella* (HARVEY in J. AGARDH) WEBER VAN BOSSE こけいわづた

Chaetosiphonaceae BLACKMAN et TANSLEY, 1902 ケートシフォン科
Blastophysa REINKE, 1888 あわみどり属
rhizopus REINKE あわみどり

Codiaceae KÜTZING, 1843 みる科
Avrainvillea DECAISNE, 1842 はうちわ属
amadelpha (MONTAGNE) A. et E. S. GEPP くさびがたはうちわ (31)
[*lacerata* var. *robustior*]
erecta (BERKELEY) A. et E. S. GEPP こてんぐのはうちわ
lacerata HARVEY ex J. AGARDH
nigricans DECAISNE くろはうちわ
obscura (C. AGARDH) J. AGARDH まるばはうちわ (31)
[*capituliformis* うみきのこ]
riukiuensis YAMADA てんぐのはうちわ
Boodleopsis A. et E. S. GEPP, 1911 もつれちょうちん属
* *pusilla* (COLLINS) TAYLOR, JOLY et BERNATOWICZ もつれちょうちん (32)
Chlorodesmis HARVEY et BAILEY, 1851 まゆはきも属
caespitosa J. AGARDH いとげのまゆはき
[*formosana*]
fastigiata (C. AGARDH) DUCKER まゆはきも
[*comosa*]
haterumana TANAKA et ITONO in ITONO ひなまゆはきも
Codium STACKHOUSE, 1797 みる属
adhaerens (CABRERA) C. AGARDH はいみる
arabicum KÜTZING なんばんはいみる
barbatum OKAMURA ひげみる (33)
[*tenue* auct. japon. いとみる]
coactum OKAMURA ねざしみる
[*coarctatum*]
contractum KJELLMAN さきぶとみる
cylindricum HOLMES ながみる
divaricatum HOLMES くろみる (34)
fragile (SURINGAR) HARIOT みる
hubbsii DAWSON はいみるもどき
intricatum OKAMURA もつれみる
latum SURINGAR ひらみる
lucasii SETCHELL in LUCAS
minus (SCHMIDT) SILVA たまみる
[*mamillosum* var. *minus*]
minutissimum NODA ひなみる
ovale ZANARDINI えつきたまみる
pugniforme OKAMURA こぶしみる
repens CROUAN frat. in VICKERS やせがたもつれみる（しゃくとりみる）
saccatum OKAMURA ふくろみる
yezoense (TOKIDA) VINOGRADOVA えぞみる (33)
[*dichotomum* auct. japon.]
[*tomentosum* auct. japon. いもせみる]

Halimeda LAMOUROUX, 1812 nom. et orth. cons. さぼてんぐさ属
discoidea DECAISNE うちわさぼてんぐさ
[*cuneata* auct. japon.]
fragilis TAYLOR
incrassata (ELLIS) LAMOUROUX みつでさぼてんぐさ (35)
macroloba DECAISNE ひろはさぼてんぐさ
micronesica YAMADA こばのさぼてんぐさ
opuntia (LINNAEUS) LAMOUROUX (36)
renschii HAUCK ひめさぼてんぐさ
[*opuntia* f. *renschii*]
tuna (ELLIS et SOLANDER) LAMOUROUX つなさぼてんぐさ
velasquezii TAYLOR ひらさぼてんぐさ
[*opuntia* f. *intermedia* YAMADA]
Pseudochlorodesmis BØRGESEN, 1925 にせまゆはき属
furcellata (ZANARDINI) BØRGESEN にせまゆはき
Rhipilia KÜTZING, 1858 にせはうちわ属
* *orientalis* A. et E. S. GEPP にせはうちわ (37)
Rhipiliopsis A. et E. S. GEPP, 1911 リピリオプシス属 (38)
echinocaulos (CRIBB) FARGHALY in KRAFT にせひめいちょう
[*Geppella japonica*]
yaeyamensis (TANAKA) KRAFT ひめいちょうもどき
[*Geppella yaeyamense*]
Tydemania WEBER VAN BOSSE, 1901 すずかけも属
expeditionis WEBER VAN BOSSE すずかけも
Udotea LAMOUROUX, 1812 はごろも属
argentea ZANARDINI おおはごろも
glaucescens HARVEY in J. AGARDH ちぢみひめいちょう
javensis (MONTAGNE) A. et E. S. GEPP ひめいちょう
orientalis A. et E. S. GEPP はごろも
yamadae TANAKA et ITONO うすばはごろも

Derbesiaceae HAUCK, 1884 つゆのいと科
Derbesia SOLIER, 1847 つゆのいと属
marina (LYNGBYE) SOLIER ほそつゆのいと (39)
minima WEBER VAN BOSSE みるつゆのいと
rhizophora YAMADA ねだしつゆのいと
tenuissima (MORIS et DE NOTARIS) CROUAN frat. つゆのいとけば (40)
Pedobesia MACRAILD et WOMERSLEY, 1974 あしつきいとげ属
lamourouxii (J. AGARDH) J. FELDMANN, LOREAU, CODOMIER et COUTÉ あしつきふといとげ
[*Derbesia lamourouxii* つゆのいと]
ryukyuensis (YAMADA et TANAKA) KOBARA et CHIHARA あしつきひめいとげ
[*Derbesia ryukyuensis* ひめつゆのいと]

緑藻に関するノート

(1) CHIHARA (1967) は *Collinsiella* 属と *Collinsiellopsis* 属に対して Collinsiellaceae 科を提案し，それが Chlorosphaerales 目に所属するとした。
(2) *Chlorochytrium inclusum* ミドリウズミモは *Spongomorpha* のいくつかの種の胞子体世代である (宮地・黒木 1976)。
(3) *Palmophyllum* 属の所属については BOURRELLY (1966) と Index Nominum Genericorum (FARR *et al.* 1979) に従った。
(4) 異名については LOKHORST (1978) の意見による。
(5) 小亀・吉田 (1988) が北海道南部から報告した。
(6) O'KELLY (1983) によれば，この属は褐藻類である。日本での記録も再検討する必要がある。
(7) *Pseudulvella* 属は *Ulvella* 属と区別できないという NIELSEN (1977) の意見に基づき，日本からの *Pseudulvella* sp. の記録（千原 1957）を収録しなかった。
(8) GOLDEN and COLE (1986) は Kornmanniaceae 科を提案し，太平洋産の *K. zostericola* が大西洋の *K. leptoderma* と区別できないとした。
(9) 岡村 (1936) は *E. coarctata, E. lingulata, E. coerulescens* を記録し，新崎 (1964) は *E. bullosa, E. fascia, E. hirsuta* を報告している。今後の分類学的な検討を期待している。
(10) f. *densa* が記載されている（岡村 1936)。
(11) 日本での記録は *U. lactuca* も含めて検討する必要がある。
(12) YENDO (1915) が北海道から報告した *S. arcta* は *S. saxatilis* の間違いと思われる。
(13) モツレグサ，イブリモツレグサ，カギモツレグサ，ウズモツレグサは配偶体世代であり，胞子体世代は *Chlorochytrium inclusum* である（宮地・黒木 1976)。
(14) 異名については宮地 (1985) の見解による。var. *tenuis* ホソモツレグサ，var. *cartilaginea* カタモツレグサが区別されている（岡村 1936)。

(15) 胞子体は *Codiolum petrocelidis* である(宮地 1984)。

(16) *Urospora acrogona* は KJELLMAN (1897) が長崎県野母崎から記載して以来記録がないので収録しなかった。

(17) VAN DEN HOEK (1979) はこの属を認めず, *W. ordinata* を *Cladophora* 属にうつした。ヒラシオグサについても検討を要する。

(18) *Ch. macrotona* と *Ch. confervicola* は確認されていないので，収録しなかった。

(19) f. *brevisegmentea* SAKAI アオタマリシオグサが区別されている (SAKAI 1964)。

(20) 異名については KOSTER (1955), WOMERSLEY (1984) に従った。

(21) KAJIMURA (1987) が隠岐島の標本に基づき記載した。

(22) 琉球から記載されて以来，採集記録がない。

(23) OLSEN and WEST (1988) が独立の属とした。

(24) *Polyphysa* 属を認める必要はないと判断した（香村，私信)。

(25) *B. caespitosa* は YENDO (1915) が伊豆下田産のただ1枚の標本によって報告したもので，ここに収録しなかった。

(26) var. *condensata* KJELLMAN が区別されている（岡村 1936)。

(27) *Pseudobryopsis* は *Trichosolen* に対して保留するように提案されたが，採用が決定されていないので，命名についての問題が残っている。日本産の種については，*Ps. myura* よりも *Ps. hainanensis* を用いる方がよいであろう。

(28) ほかに f. *minor* (NARITA 1915) が記載されたが，実体不明である。

(29) OHBA and ENOMOTO (1987), PETERSON (1972) は *C. racemosa* が環境条件によって形態を著しく変えることを示した。種内の分類群については再検討が必要であろう。

(30) TANAKA (1965) に従って変種名を用いる。

(31) 異名については OLSEN-STOJKOVICH (1985) による。

(32) J. TANAKA (1987) が南西諸島から報告した。

(33) SILVA（私信）の意見に従う。

(34) f. *hybrida* が記載されている（岡村 1936)。

(35) f. *lamourouxii* ラモローサボテングサ，f. *ovata* コサボテングサが区別される（岡村 1936)。

(36) f. *cordata* が区別される（岡村 1936)。

(37) ITONO (1986) が報告した。

(38) 異名は KRAFT (1986) に従った。

(39) 配偶体は *Halicystis ovalis* である (KOBARA and CHIHARA 1981)。

(40) 配偶体は *Halicystis parvula* である (KOBARA and CHIHARA 1981)。

PHAEOPHYCEAE KJELLMAN in ENGLER et PRANTL, 1891 褐藻綱 (FUCOPHYCEAE WARMING, 1884)

ECTOCARPALES SETCHELL et GARDNER, 1922 しおみどろ目

Ectocarpaceae C. AGARDH, 1828 しおみどろ科

Acinetospora BORNET, 1892 アキネトスポラ属

crinita (CARMICHAEL ex HARVEY in HOOKER) KORNMANN

[*Ectocarpus filamentosus* NODA]

[*Ectocarpus ugoensis*]

Bachelotia (BORNET) KUCKUCK et HAMEL, 1939 バシェロティア属

* *antillarum* (GRUNOW) GERLOFF (1)

Ectocarpus LYNGBYE, 1819 nom. cons. しおみどろ属 (2)

acuto-ramulis NODA とがりえだしおみどろ

arctus KÜTZING けなししおみどろ

[*confervoides*]

brevicellularis NODA たんぽしおみどろ

cladosiphoniae NODA まばらえだしおみどろ

commixtus NODA ほそしおみどろ

[*tenellus* NODA]

confusiophyllus NODA ふしすじものしおみどろ

cystophyllophilus NODA かいふもくのしおみどろ

densus OHTA

dictyoptericola NODA やはずのしおみどろ

elachistaeformis HEYDRICH いとしおみどろ

fusiformis NAGAI つむがたしおみどろ

hemisphaericus SAUNDERS

f. *minor* SAUNDERS すがものしおみどろ

hornericola NODA ぎばさのしおみどろ

kjellmanioides NODA くされえだのしおみどろ

laminariae NODA えぞのしおみどろ

laurenciae YAMADA ちゃぼしおみどろ

lepasicola NODA えぼしのしおみどろ

minor NODA ひめひもしおみどろ

mitchelloides NODA はねげしおみどろ

monzensis Noda et Konno もんぜんしおみどろ
niigatensis Noda ほそながしおみどろ
[*hiemalis* Noda]
oblongatus Noda とげものしおみどろ
obtuosus Noda まるみしおみどろ
penicillatus (C. Agardh) Kjellman えふでしおみどろ
plasticola Noda ほそみしおみどろ
plumosus Noda えながしおみどろ
polysiphoniae Noda いとぐさしおみどろ
rotundato-apicalis Noda et Honda in Honda et Noda えなししおみどろ
sadoensis Noda ひめおけさしおみどろ
sargassicaulinus Noda おおばもくのしおみどろ
sargassiphyllus Noda もくのはしおみどろ
scytosiphonae Noda かやものしおみどろ
shiiyaensis Noda ほそえだしおみどろ
shimokitaensis Ohta しもきたしおみどろ
siliculosus (Dillwyn) Lyngbye しおみどろ
socialis Setchell et Gardner ひめみるしおみどろ
sphaericus Ohta まるしおみどろ
tappiensis Ohta たっぴしおみどろ
tasshaensis Noda おけさしおみどろ
tsugaruensis Ohta つがるしおみどろ
yezoensis Yamada et Tanaka えぞしおみどろ
zosterae Noda et Ohta in Ohta ひめもつきしおみどろ

Feldmannia Hamel, 1939 フェルドマニア属
formosana (Yamada) Itono なんかいしおみどろ
[*Ectocarpus formosanus*]
indica (Sonder) Womersley et Bailey ながみしおみどろ
[*Ectocarpus indicus*]
[*Giffordia indica*]
irregularis (Kützing) Hamel みるしおみどろ
[*Ectocarpus izuensis*]

Gononema Kuckuck et Skottsberg, 1921 ゴノネマ属
aecidioides (Rosenvinge) Pedersen わかめやどりみどろ
[*Streblonema aecidioides*]

Hincksia J. E. Gray, 1864 ヒンクシア属 (3)
breviarticulatus (J. Agardh) Silva たまがたしおみどろ
[*Ectocarpus breviarticulatus*]
[*Giffordia breviarticulata*]
granulosa (J. E. Smith) Silva
[*Ectocarpus granulosus*]
[*Giffordia granulosa*]
mitchellae (Harvey) Silva たわらがたしおみどろ
[*Ectocarpus mitchellae*]
[*Giffordia mitchellae*]
ovata (Kjellman) Silva
[*Ectocarpus ovatus*]
[*Giffordia ovata*]
sandriana (Zanardini) Silva
[*Ectocarpus sandrianus*]
[*Giffordia sandriana*]

Laminariocolax Kylin, 1947 ラミナリオコラックス属
draparnaldioides Noda つるぎみどろも

Pilayella Bory, 1823 ぴらえら属
littoralis (Linnaeus) Kjellman ぴらえら
petaloniae Noda ひなぴらえら

Spongonema Kützing, 1849 かぎしおみどろ属
tomentosum (Hudson) Kützing かぎしおみどろ

Streblonema Derbès et Solier in Castagne, 1851 やどりみどろ属
codii Barton みるのいと
evagatum Setchell et Gardner こぶやどりみどろ
fasciculatum Thuret in Le Jolis
gracilicola Noda かばのりみどろ

Sorocarpaceae Pedersen, 1977 いそぶどう科

Botrytella Bory, 1822 いそぶどう属 (4)
micromora Bory いそぶどう
[*Sorocarpus uvaeformis*]

Polytretus Sauvageau, 1900 きたしおみどろ属
reinboldii (Reinke) Sauvageau きたしおみどろ (5)
[*Ectocarpus intricatus*]
[*Ectocarpus iwadatensis*]
[*Ectocarpus recurvatus*]

RALFSIALES Nakamura, 1972 いそがわら目

Lithodermataceae Hauck, 1883 リトデルマ科

Pseudolithoderma Svedelius in Engler et Prantl, 1911 にせいしのかわ属
subextensum (Waern) S. Lund にせいしのかわ

Mesosporaceae J. Tanaka et Chihara, 1982 メソスポラ科

Mesospora WEBER VAN BOSSE, 1911 メソスポラ属
schmidtii WEBER VAN BOSSE

Ralfsiaceae FARLOW, 1881 いそがわら科
Analipus KJELLMAN, 1889 まつも属
filiformis (RUPRECHT) PAPENFUSS いとまつも
[*Chordaria gunjii*]
japonicus (HARVEY) WYNNE まつも
[*Heterochordaria abietina*]
Diplura HOLLENBERG, 1969 くろはんもん属
simplex J. TANAKA et CHIHARA くろはんもん
Endoplura HOLLENBERG, 1969 きんいろはんもん属
aurea HOLLENBERG きんいろはんもん
Hapterophycus SETCHELL et GARDNER in SETCHELL, 1912 いそがわらもどき属
canaliculatus SETCHELL et GARDNER いそがわらもどき
echigoensis NODA
Heteroralfsia KAWAI, 1989 いしつきごびあ属 (6)
saxicola (OKAMURA et YAMADA) KAWAI いしつきごびあ
[*Gobia saxicola*]
[*Saundersella saxicola*]
Ralfsia BERKELEY in SMITH et SOWERBY, 1843 いそがわら属
borneti KUCKUCK
endopluroides J. TANAKA et CHIHARA
expansa (J. AGARDH) J. AGARDH
fungiformis (GUNNERUS) SETCHELL et GARDNER いそがわら
integra HOLLENBERG
pedicellata J. TANAKA et CHIHARA
tenuis KYLIN
verrucosa (ARESCHOUG) ARESCHOUG いそいわたけ（いそはんもん，はんもんそう）

CHORDARIALES SETCHELL et GARDNER, 1925 ながまつも目

Acrotrichaceae KUCKUCK, 1929 にせもずく科
Acrothrix KYLIN, 1907 にせもずく属
gracilis KYLIN きたにせもずく
pacifica OKAMURA et YAMADA in YAMADA にせもずく (7)

Chordariaceae GREVILLE, 1830 ながまつも科
Chordaria C. AGARDH, 1817 nom. cons. ながまつも属
flagelliformis (O. F. MÜLLER) C. AGARDH ながまつも (8)
gracilis SETCHELL et GARDNER ほそまつも
Cladosiphon KÜTZING, 1843 おきなわもずく属
okamuranus TOKIDA おきなわもずく
[*Eudesme virescens* sensu OKAMURA]
Eudesme J. AGARDH, 1882 にせふともずく属
virescens (CARMICHAEL ex HARVEY in HOOKER) J. AGARDH にせふともずく
Heterosaundersella TOKIDA, 1942 からふともずく属
hattoriana TOKIDA からふともずく
Myriogloea KUCKUCK ex OLTMANNS, 1922 きつねのお属
simplex (SEGAWA et OHTA) INAGAKI きつねのお
Papenfussiella KYLIN, 1940 くろも属
kuromo (YENDO) INAGAKI くろも (9)
[*Myriocladia kuromo*]
Saundersella KYLIN, 1940 もつきちゃそうめん属
simplex (SAUNDERS) KYLIN もつきちゃそうめん
[*Gobia simplex* ごびあ]
Sauvageaugloia HAMEL ex KYLIN, 1940 くろもずく属
ikomae (NARITA) INAGAKI くろもずく
Sphaerotrichia KYLIN, 1940 いしもずく属
divaricata (C. AGARDH) KYLIN いしもずく (10)
[*japonica*]
[*Chordaria cladosiphon* くさもずく]
[*Chordaria firma*]
sadoensis NODA おけさもずく
Tinocladia KYLIN, 1940 ふともずく属
crassa (SURINGAR) KYLIN ふともずく
[*Eudesme crassa*]

Elachistaceae KJELLMAN, 1890 なみまくら科
Elachista DUBY, 1830 nom. cons. なみまくら属
coccophorae TAKAMATSU すぎもくのなみまくら
confusicola NODA いとなみまくら
crassa TAKAMATSU (11)
flaccida (DILLWYN) FRIES
globosa TAKAMATSU なみまくら
[*fucicola* sensu OKAMURA]
mollis TAKAMATSU
nigra TAKAMATSU
nipponica UMEZAKI
orbicularis (OHTA) SKINNER

sadoensis Noda ぎばさなみまくら
sargassicola Noda もつきなみまくら
taeniaeformis Yamada ひるなみまくら
tenuis Yamada ほそなみまくら (12)
vellosa Takamatsu
zosterae Noda in Noda et Kitami あまものなみまくら
Halothrix Reinke, 1888 そめわけぐさ属
ambigua Yamada そめわけぐさ (13)
coccophorae Ohta
lumbricalis (Kützing) Reinke ひなのそめわけぐさ
sadoensis Noda おけさそめわけぐさ
tortuosa Takamatsu
Leptonematella Silva, 1959 レプトネマテラ属
**fasciculata* (Reinke) Silva (14)

Ishigeaceae Okamura in Segawa, 1935 いしげ科
Ishige Yendo, 1907 いしげ属
okamurae Yendo いしげ
sinicola (Setchell et Gardner) Chihara いろろ
[*foliacea*]

Leathesiaceae Farlow, 1881 ねばりも科
Leathesia S. F. Gray, 1821 ねばりも属
crassipilosa Takamatsu えだねけねばりも
difformioides Takamatsu (15)
difformis (Linnaeus) Areschoug ねばりも
japonica Inagaki こごめねばりも
monilicellulata Takamatsu なんきんねばりも
primaria Takamatsu いとねばりも
pulvinata Takamatsu ひなねばりも
sadoensis Inagaki おけさねばりも
saxicola Takamatsu いわねばりも (16)
[*granulosa*]
sphaerocephala Yamada ひめねばりも
tsugaruensis Ohta
yezoensis Inagaki こつぶねばりも
[*umbellata* sensu Okamura]
Myriactula Kuntze, 1898 ミリアクチュラ属 (17)
clavata (Takamatsu) Feldmann
sargassi (Yendo) Feldmann ごのけのり
saromaensis Yamada et Iwamoto in Iwamoto もくのつゆ
Petrospongium Nägeli ex Kützing, 1858 しわのかわ属
rugosum (Okamura) Setchell et Gardner しわのかわ
[*Cylindrocarpus rugosus*]

Myrionemataceae Nägeli, 1847 ミリオネマ科
Ascocyclus Magnus, 1874 アスコキクルス属 (18)
dichotomus Ohta
Compsonema Kuckuck, 1899 コンプソネマ属
chordae Noda つるものはりも
coccophorae Noda すぎもくのはりも
coniferum Setchell et Gardner (19)
dictyotoides Noda et Honda in Honda et Noda あみぢのはりも
intercalare Noda かいせいはりも
nummuloides Setchell et Gardner もくのはりも
oblongum Noda in Honda et Noda ながみのはりも
secundum Setchell et Gardner
f. *terminale* Setchell et Gardner
Hecatonema Sauvageau, 1898 ヘカトネマ属
maculans (Collins) Sauvageau そろいへかとねま
terminale (Kützing) Kylin へかとねま
Microspongium Reinke, 1888 ミクロスポンギウム属
globosum Reinke (20)
[*Myrionema globosum* まるがたみりおねま]
Myrionema Greville, 1827 ミリオネマ属
acrochaetiae Noda たんじゅんみりおねま
corunnae Sauvageau みりおねま
dichotomum Noda et Honda in Honda et Noda ふたまたみりおねま
grateloupiae Noda まつまえみりおねま
obscurum Setchell et Gardner
orbiculare J. Agardh
padinae Noda
tenue Noda et Honda in Honda et Noda
terminale Noda
Protectocarpus Kornmann, 1955 プロテクトカルプス属
* *speciosus* (Børgesen) Kornmann (21)
[*Compsonema ramulosa* sensu Noda てんいこんぶそねま]

Spermatochnaceae Kjellmann, 1890 もずく科
Nemacystus Derbès et Solier, 1850 もずく属
decipiens (Suringar) Kuckuck もずく
Stilophora J. Agardh, 1841 nom. cons. ひもまくら属

rhizodes (TURNER) J. AGARDH ひもまくら

SCYTOSIPHONALES J. FELDMANN, 1949かやものり目

Chnoosporaceae SETCHELL et GARDNER, 1925 むらちどり科

Chnoospora J. AGARDH, 1847 むらちどり属
implexa J. AGARDH むらちどり
minima (HERING) PAPENFUSS ぼうがたむらちどり
[*pacifica*]

Scytosiphonaceae FARLOW, 1881 かやものり科

Colpomenia (ENDLICHER) DERBÈS et SOLIER in CASTAGNE, 1851 ふくろのり属
bullosa (SAUNDERS) YAMADA わたも
[*sinuosa* f. *deformans*]
phaeodactyla WYNNE et J. N. NORRIS
sinuosa (MERTENS ex ROTH) DERBÈS et SOLIER in CASTAGNE ふくろのり
Endarachne J. AGARDH, 1896 はばのり属
binghamiae J. AGARDH はばのり
Hydroclathrus BORY, 1825 かごめのり属
clathratus (C. AGARDH) HOWE かごめのり
Petalonia DERBÈS et SOLIER, 1850 nom. cons. せいようはばのり属 (22)
fascia (O. F. MÜLLER) KUNTZE せいようはばのり
[*Ilea fascia*]
zosterifolia (REINKE) KUNTZE ほそばせいようはばのり
Rosenvingea BØRGESEN, 1914 もさくだふくろ属
intricata (J. AGARDH) BØRGESEN もさくだふくろ
orientalis (J. AGARDH) BØRGESEN
Scytosiphon C. AGARDH, 1820 nom. cons. かやものり属
lomentaria (LYNGBYE) LINK かやものり (23)

DICTYOSIPHONALES SETCHELL et GARDNER, 1925 ういきょうも目

Asperococcaceae FARLOW, 1881 こもんぶくろ科

Asperococcus LAMOUROUX, 1813 こもんぶくろ属
bullosus LAMOUROUX こもんながぶくろ (24)
[*turneri*]
Melanosiphon WYNNE, 1969 きたいわひげ属
intestinalis (SAUNDERS) WYNNE きたいわひげ
[*Myelophycus intestinalis*]
Myelophycus KJELLMAN in ENGLER et PRANTL, 1893 いわひげ属
* *cavum* J. TANAKA et CHIHARA うつろいわひげ (25)
simplex (HARVEY) PAPENFUSS いわひげ
[*caespitosus*]

Coilodesmaceae SETCHELL et GARDNER, 1925 えぞぶくろ科

Akkesiphycus YAMADA et TANAKA, 1944 こんぶもどき属
lubricus YAMADA et TANAKA こんぶもどき
Coilodesme STRÖMFELT, 1886 えぞふくろ属
cystoseirae (RUPRECHT) SETCHELL et GARDNER ほそえぞふくろ
japonica YAMADA えぞふくろ
[*cystoseirae* sensu YENDO]

Delamareaceae A. D. ZINOVA, 1953 にせかやも科

Delamarea HARIOT, 1889 にせかやも属
attenuata (KJELLMAN) ROSENVINGE にせかやも
Stschapovia A. D. ZINOVA, 1954 シチャポビア属
flagellaris A. D. ZINOVA

Dictyosiphonaceae KÜTZING, 1849 ういきょうも科

Dictyosiphon GREVILLE, 1830 nom. cons. ういきょうも属
chordaria ARESCHOUG ふとばういきょうも
corymbosus KJELLMAN
foeniculaceus (HUDSON) GREVILLE ういきょうも
hippuroides (LYNGBYE) KÜTZING ふとういきょうも

Punctariaceae (THURET) KJELLMAN, 1880 はばもどき科

Litosiphon HARVEY, 1849 いそひげも属
groenlandicus LUND いそひげも
Pogotrichum REINKE, 1892 こぶのひげ属
yezoense (YAMADA et NAKAMURA in YAMADA) SAKAI et SAGA こぶのひげ
[*Litosiphon yezoense*]
Punctaria GREVILLE, 1830 はばもどき属
conglomerata YAMADA et IWAMOTO in IWAMOTO ひだはばもどき
flaccida NAGAI ちしまはばもどき
kinoshitae YAMADA et IWAMOTO in IWAMOTO おおばはばもどき

latifolia GREVILLE はばもどき
mageshimensis TANAKA ごあんめ
occidentalis SETCHELL et GARDNER がさがさはばもどき (26)
[*chartacea* sensu YENDO]
pilosa UMEZAKI けぶかはばもどき
plantaginea (ROTH) GREVILLE はばだまし (26)
[*rubescens* sensu YENDO]
projecta YAMADA ゆるぢはばもどき
tenuis YAMADA et IWAMOTO in IWAMOTO うすばはばもどき

Striariaceae KJELLMAN, 1890 よこじまのり科
Kjellmania REINKE, 1888 さめずぐさ属
arasakii YAMADA さめずぐさ
Striaria GREVILLE, 1828 よこじまのり属
attenuata (GREVILLE) GREVILLE よこじまのり

CUTLERIALES OLTMANNS, 1922 むちも目
Cutleriaceae HAUCK, 1883 むちも科
Cutleria GREVILLE, 1830 むちも属
adspersa (ROTH) DE NOTARIS けべりぐさ
cylindrica OKAMURA むちも
multifida (TURNER) GREVILLE ひらむちも

SPHACELARIALES OLTMANNS, 1922 くろがしら目
Sphacelariaceae DECAISNE, 1842 くろがしら科
Sphacelaria LYNGBYE, 1819 くろがしら属 (27)
axilaris TAKAMATSU
caespitosa TAKAMATSU
**californica* SAUVAGEAU はねぐんせんくろがしら (28)
divaricata MONTAGNE
f. *japonica* TAKAMATSU
expansa NODA じゅうたんくろがしら
hizikiae OHTA et NODA ひじきのくろがしら
iridaeophytica NAGAI ぎんあんくろがしら
iwagasakensis NODA えちごくろがしら
linearis TAKAMATSU
lutea TAKAMATSU
plumigera HOLMES はねくろがしら
prostrata TAKAMATSU にっぽんまたざきくろがしら
pyriformis NODA なしのみくろがしら
radiata TAKAMATSU くびれくろがしら
rigidula KÜTZING わいじがたくろがしら (29)
[*furcigera*]
sessilis TAKAMATSU
shiiyaensis NODA ほそえくろがしら
subfusca SETCHELL et GARDNER みつまたくろがしら
tenuis TAKAMATSU
tribuloides MENEGHINI ぐんせんくろがしら
variabilis SAUVAGEAU またさきくろがしら
viridis TAKAMATSU
yamadae SEGAWA つくばねくろがしら

Stypocaulaceae OLTMANNS, 1922 かしらざき科
Halopteris KÜTZING, 1843 かしらざき属
filicina (GRATELOUP) KÜTZING かしらざき
scoparia (LINNAEUS) SAUVAGEAU えぞかしらざき

DESMARESTIALES SETCHELL et GARDNER, 1925 うるしぐさ目
Desmarestiaceae (THURET) KJELLMAN, 1880 うるしぐさ科
Desmarestia LAMOUROUX, 1813 nom. cons. うるしぐさ属
ligulata (STACKHOUSE) LAMOUROUX うるしぐさ
tabacoides OKAMURA たばこぐさ
viridis (MÜLLER) LAMOUROUX けうるしぐさ

SPOROCHNALES SAUVAGEAU, 1926 けやりも目
Sporochnaceae GREVILLE, 1830 けやりも科
Carpomitra KÜTZING, 1843 nom. cons. いちめがさ属
cabrerae (CLEMENTE) KÜTZING いちめがさ
Nereia ZANARDINI, 1846 うみぼっす属
intricata YAMADA うみぼっす
Sporochnus C. AGARDH, 1817 けやり属
radiciformis (R. BROWN ex TURNER) C. AGARDH たまけやり
scoparius HARVEY けやり

LAMINARIALES KYLIN, 1917 こんぶ目
Alariaceae SETCHELL et GARDNER, 1925 ちがいそ科
Alaria GREVILLE, 1830 nom. cons. あいぬわかめ属
angusta KJELLMAN ほそばわかめ
crassifolia KJELLMAN in KJELLMAN et PETERSEN ちがいそ
fistulosa POSTELS et RUPRECHT おにわかめ
paradisea (MIYABE et NAGAI) WIDDOWSON ふうちょ

うわかめ
[*Pleuropterum paradiseum*]
praelonga KJELLMAN あいぬわかめ
taeniata KJELLMAN くしろわかめ
Undaria SURINGAR, 1873 わかめ属
peterseniana (KJELLMAN in KJELLMAN et PETERSEN) OKAMURA あおわかめ
pinnatifida (HARVEY) SURINGAR わかめ (30)
undarioides (YENDO) OKAMURA ひろめ

Chordaceae DUMORTIER, 1822 つるも科
Chorda STACKHOUSE, 1797 つるも属
filum (LINNAEUS) STACKHOUSE つるも

Laminariaceae BORY, 1827 こんぶ科
Agarum BORY, 1826 nom. cons. あなめ属
cribrosum BORY あなめ (31)
oharaense YAMADA おおのあなめ
Arthrothamnus RUPRECHT, 1848 ねこあしこんぶ属
bifidus (GMELIN) RUPRECHT in MIDDENDORFF ねこあしこんぶ
Costaria GREVILLE, 1830 すじめ属
costata (C. AGARDH) SAUNDERS すじめ (32)
Cymathaere J. AGARDH, 1868 みすじこんぶ属
japonica MIYABE et NAGAI in NAGAI あつばみすじこんぶ
Ecklonia HORNEMANN, 1828 かじめ属
cava KJELLMAN in KJELLMAN et PETERSEN かじめ
kurome OKAMURA くろめ (33)
stolonifera OKAMURA つるあらめ
Eckloniopsis OKAMURA, 1927 あんとくめ属
radicosa (KJELLMAN in KJELLMAN et PETERSEN) OKAMURA あんとくめ (34)
Eisenia ARESCHOUG, 1876 あらめ属
arborea ARESCHOUG さがらめ
bicyclis (KJELLMAN in KJELLMAN et PETERSEN) SETCHELL あらめ
Hedophyllum SETCHELL, 1901 くろしおめ属
kuroshioense SEGAWA くろしおめ (35)
Kjellmaniella MIYABE, 1902 とろろこんぶ属
crassifolia MIYABE in OKAMURA がごめ
gyrata (KJELLMAN) MIYABE in OKAMURA とろろこんぶ (36)
Laminaria LAMOUROUX, 1813 nom. cons. こんぶ属
angustata KJELLMAN in KJELLMAN et PETERSEN みついしこんぶ
cichorioides MIYABE in OKAMURA ちぢみこんぶ
coriacea MIYABE in OKAMURA がっがらこんぶ
diabolica MIYABE in OKAMURA おにこんぶ (37)
japonica ARESCHOUG まこんぶ (38)
longissima MIYABE in OKAMURA ながこんぶ
[*angustata* var. *longissima*]
longipedalis OKAMURA えながこんぶ (かきじまこんぶ)
ochotensis MIYABE in OKAMURA りしりこんぶ
religiosa MIYABE in OKAMURA ほそめこんぶ
saccharina (LINNAEUS) LAMOUROUX
f. *linearis* J. AGARDH からふとこんぶ
sachalinensis (MIYABE) MIYABE in MIYABE et NAGAI からふとところこんぶ
yendoana MIYABE in OKAMURA えんどうこんぶ
yezoensis MIYABE in OKAMURA ごへいこんぶ

Pseudochordaceae KAWAI et KUROGI, 1985 にせつるも科 (39)
Pseudochorda YAMADA, TOKIDA et INAGAKI in INAGAKI, 1958 にせつるも属
* *gracilis* KAWAI et NABATA ほそつるも
nagaii (TOKIDA) INAGAKI にせつるも
[*Chorda nagaii*]

SYLINGODERMATALES HENRY, 1984 うすばおおぎ目
Syringodermataceae HENRY, 1984 うすばおおぎ科
Syringoderma LEVRING, 1940 うすばおおぎ属
abyssicola (SETCHELL et GARDNER) LEVRING うすばおおぎ (40)
[*australe* sensu YAMADA et MATSUNAGA]

DICTYOTALES KJELLMAN in ENGLER et PRANTL, 1896 あみじぐさ目
Dictyotaceae LAMOUROUX ex DUMORTIER, 1822 あみじぐさ科
Dictyopteris LAMOUROUX, 1809 nom. cons. やはずぐさ属 (41)
divaricata (OKAMURA) OKAMURA えぞやはず
fucoides TANAKA おおばやはず
latiuscula (OKAMURA) OKAMURA やはずぐさ
papenfussii TANAKA りぼんやはず
plagiogramma (MONTAGNE) VICKERS すじやはず

polypodioides (De Candolle) Lamouroux うらぼしやはず (42)
[*membranacea*]
prolifera (Okamura in De Toni et Okamura) Okamura へらやはず
punctata Noda うすばやはず
repens (Okamura) Børgesen ひめやはず
undulata Holmes しわやはず
Dictyota Lamouroux, 1809 nom. cons. あみじぐさ属 (43)
adhaerens Noda いわあみじ
binghamiae J. Agardh びんがあみじ
cervicornis Kützing よれあみじ
dentata Lamouroux とげあみじ
dichotoma (Hudson) Lamouroux あみじぐさ
dilatata Yamada さきびろあみじ
divaricata Lamouroux かずのあみじ
flabellata (Collins) Setchell et Gardner せんけいあみじぐさ
indica Sonder in Kützing
linearis (C. Agardh) Greville いとあみじ
maxima Zanardini おおばあみじぐさ
patens J. Agardh こもんあみじ
spathulata Yamada へらあみじぐさ
spinulosa Harvey in Hooker et Arnott はりあみじ
virellus Noda みどりあみじぐさ
Dilophus J. Agardh, 1882 にせあみじ属 (44)
okamurae Dawson ふくりんあみじ
[*marginatus* Okamura]
Distromium Levring, 1940 ふたえおおぎ属
decumbens (Okamura) Levring ふたえおおぎ
[*Chlanidophora repens*]
[*Clanidote decumbens*]
Homoeostrichus J. Agardh, 1894 やれおおぎ属
flabellatus Okamura やれおおぎ
Lobophora J. Agardh, 1894 はいおおぎ属
variegata (Lamouroux) Womersley はいおおぎ
[*Gymnosorus collaris*]
[*Pocockiella variegata*]
Pachydictyon J. Agardh, 1894 さなだぐさ属
coriaceum (Holmes) Okamura さなだぐさ
Padina Adanson, 1763 nom. cons. うみうちわ属
arborescens Holmes うみうちわ
australis Hauck うすばうみうちわ (45)
boryana Thivy in Taylor あかばうみうちわ
[*commersonii*]
crassa Yamada こなうみうちわ
japonica Yamada おきなうちわ
minor Yamada うすゆきうちわ
stipitata Tanaka et Nozawa in Tanaka えつきうみうちわ
Spatoglossum Kützing, 1843 こもんぐさ属
cornigerum J. Agardh
pacificum Yendo こもんぐさ
solieri (Chauvin ex Montagne) Kützing
variabile Figari et De Notaris ほそばこもんぐさ
Stypopodium Kützing, 1843 ぢがみぐさ属
zonale (Lamouroux) Papenfuss ぢがみぐさ
[*lobatum*]
Zonaria C. Agardh, 1817 nom. cons. しまおおぎ属
diesingiana J. Agardh しまおおぎ
stipitata Tanaka et K. Nozawa えつきしまおおぎ

FUCALES Kylin, 1917 ひばまた目

Cystoseiraceae Kützing, 1843 うがのもく科
Coccophora Greville, 1830 すぎもく属
langsdorfii (Turner) Greville すぎもく
Cystoseira C. Agardh, 1820 nom. cons. うがのもく属
crassipes (Mertens ex Turner) C. Agardh ねぶともく
[*Cystophyllum crassipes*]
geminata C. Agardh えぞもく
[*Cystophyllum geminatum*]
hakodatensis (Yendo) Fensholt うがのもく
[*Cystophyllum hakodatense*]
Hormophysa Kützing, 1843 やばねもく属
cuneiformis (Gmelin) Silva やばねもく (46)
[*triquetra*]
[*Cystoseira prolifera*]
Myagropsis Kützing, 1843 じょろもく属
myagroides (Mertens ex Turner) Fensholt じょろもく (47)
[*yendoi* Fensholt]
[*Cystophyllum caespitosum* かいふもく]
[*Cystophyllum sisymbrioides*]
[*Cystophyllum turneri* ひえもく]

Fucaceae Adanson, 1763 ひばまた科
Fucus Linnaeus, 1753 ひばまた属
distichus Linnaeus

ssp. *evanescens* (C. AGARDH) POWELL ひばまた
[*evanescens*]
Pelvetia DECAISNE et THURET, 1845 えぞいしげ属
wrightii OKAMURA えぞいしげ (48)

Sargassaceae KÜTZING, 1843 ほんだわら科
Hizikia OKAMURA, 1932 ひじき属
fusiformis (HARVEY) OKAMURA ひじき (49)
Sargassum C. AGARDH, 1820 nom. cons. ほんだわら属 (50)
alternato-pinnatum YAMADA きればもく (51)
[*asymmetricum* かたわもく]
ammophilum YOSHIDA et T. KONNO in KONNO et YOSHIDA すなびきもく
angustifolium C. AGARDH ほそばもく
[*vulgare* f. *linearifolium* sensu YENDO]
assimile HARVEY つくしもく
autumnale YOSHIDA あきよれもく
berberifolium J. AGARDH べりべりもく
brevifolium KÜTZING ひめこもく
carpophyllum J. AGARDH まじりもく
confusum C. AGARDH ふしすじもく
* *crassifolium* J. AGARDH あつばもく (52)
crispifolium YAMADA こぶくろもく
cristaefolium C. AGARDH とさかもく
duplicatum J. AGARDH ふたえもく
filicinum HARVEY しだもく
fulvellum (TURNER) C. AGARDH ほんだわら
[*enerve*]
giganteifolium YAMADA in OKAMURA おおばのこぎりもく
hemiphyllum (TURNER) C. AGARDH いそもく
henslowianum C. AGARDH ex J. AGARDH
var. *condensatum* YAMADA えながもく
horneri (TURNER) C. AGARDH あかもく
hyugaense YAMADA ひゅうがもく
ilicifolium (TURNER) C. AGARDH
var. *conduplicatum* GRUNOW ふたえひいらぎもく
kashiwajimanum YENDO とさもく
kushimotense YENDO しろこもく
macrocarpum C. AGARDH のこぎりもく
[*serratifolium* sensu YENDO]
micracanthum (KÜTZING) ENDLICHER とげもく
microceratium (MERTENS ex TURNER) C. AGARDH ふしいともく
miyabei YENDO みやべもく
[*kjellmanianum*]
muticum (YENDO) FENSHOLT たまははきもく
[*kjellmanianum* f. *muticum*]
nigrifolium YENDO ならさも
nipponicum YENDO たまなしもく
okamurae YOSHIDA et T. KONNO ひらねじもく
pallidum (TURNER) C. AGARDH うすいろもく
patens C. AGARDH やつまたもく (53)
piluliferum (TURNER) C. AGARDH まめたわら (54)
pinnatifidum HARVEY からくさもく
polycystum C. AGARDH こばもく
* *polyporum* MONTAGNE (55)
ringgoldianum HARVEY
ssp. *ringgoldianum* おおばもく
ssp. *coreanum* (J. AGARDH) YOSHIDA やなぎもく
sagamianum YENDO ねじもく
salicifolioides YAMADA ふくれみもく
sandei REINBOLD in WEBER VAN BOSSE なんかいもく
segii YOSHIDA ながしまもく
[*racemosum* YAMADA et SEGI]
[*ringgoldianum* f. *elliptica* まるばのがらも]
serratifolium (C. AGARDH) C. AGARDH うすばのこぎりもく
siliquastrum (TURNER) C. AGARDH よれもく
[*tortile*]
siliquosum J. AGARDH きしゅうもく
tenuifolium YAMADA うすばもく
thunbergii (MERTENS ex ROTH) KUNTZE うみとらのお
tosaense YENDO たつくり
trichophyllum (KÜTZING) KUNTZE いとよれもく
yamadae YOSHIDA et T. KONNO あずまねじもく
yamamotoi YOSHIDA よれもくもどき
yendoi OKAMURA et YAMADA in YAMADA えんどうもく
yezoense (YAMADA) YOSHIDA et T. KONNO えぞのねじもく
[*sagamianum* var. *yezoense*]
Turbinaria LAMOUROUX, 1825 らっぱもく属
ornata (TURNER) J. AGARDH らっぱもく
trialata (J. AGARDH) KÜTZING たかつきもく

褐藻に関するノート

(1) TANAKA and CHIHARA (1987) が石垣島から報告した。

(2) 日本産の種は再検討が必要で，もっと少数の種に纏められるであろう。

(3) *Giffordia* よりも *Hincksia* の名前を用いるのが正しいという Silva, Meñez and Moe (1987) の意見に従う。

(4) *Sorocarpus* の名前は保留されていないので，*Botrytella* を用いるのが正しい。

(5) f. *minutus* Kurogi が区別された。異名は Kurogi (1978) による。

(6) Kawai (1989) の研究により新しい属を代表することが示された。

(7) f. *crassa* フトニセモズクが区別された (Inagaki 1954)。

(8) f. *chordaeformis* ヒモナガマツモ，f. *ramusculifera* マバラナガマツモが区別されている (Inagaki 1958)。

(9) f. *densa* フサクロモ，f. *gracilis* ホソクロモが区別される (Inagaki 1958)。

(10) f. *chordarioides* ニセナガマツモ，f. *epiphytica* ヤセモズク，f. *gracilis* ホソバノニセナガマツモが区別された (Inagaki 1958)。

(11) Takamatsu (1938) は f. *lumbricalis*, f. *rigida* を区別した。

(12) Takamatsu (1938) により f. *pacifica* が区別された。

(13) Takamatsu (1938) は f. *rigida* を区別した。

(14) Tanaka (1988) により北海道南部から報告された。

(15) f. *globosa* (Takamatsu 1939) が区別された。

(16) 異名は Inagaki (1958) による。

(17) *Gonodia* 属は *Myriactula* の異名とされているので，*Gonodia fusiformis* Noda は命名法上も検討を要する。

(18) *Myrionema* または *Hecatonema* の異名とされている (Loiseaux 1968)。日本産の種については特徴となる ascocyst も示されておらず，再検討を要する。

(19) Kajimura (1979) が隠岐島から報告した。

(20) Tanaka (1987) が記録した。

(21) Tanaka (1986) の報告による。

(22) *Ilea zosterifolia* Noda もこの属に入ると思われる。*Ilea* は *Petalonia* の異名である。

(23) f. *complanatus*, f. *cylindricus nanus* ヒメカヤモ，f. *cylindricus major* イトカヤモ，f. *tortilis* ヨレカヤモが記録されている (Tokida 1954，岡村 1936)。

(24) 異名は Womersley (1987) による。

(25) Tanaka and Chihara (1984) が伊豆から記載した。

(26) 異名は太田 (1984) による。

(27) *S. apicalis* Takamatsu は菌の寄生したもの。*S. novae-caledoniae* は産地不明で日本に産するかどうか疑わしい。*S. radicans* も実体不明。

(28) 北山・吉田 (1989) が青森県から記録した。

(29) 異名は Prud'homme van Reine (1982) による。

(30) f. *distans* ナンブワカメ，f. *narutensis* ナルトワカメ，var. *elongata*, var. *vulgaris* などが記載されている (岡村 1936, Suringar 1872)。

(31) f. *rishiriense* リシリアナメ，f. *rugosum* ザラアナメ，f. *yakishiriense* テウリアナメが区別されている (Yamada 1974)。

(32) f. *cuneata*, f. *latifolia* が区別された (Nagai 1941)。

(33) f. *contorta*, f. *latissima*, f. *plana* が区別された（岡村 1936)。

(34) f. *elongata*, f. *latifolia* が区別された（岡村 1936)。

(35) Widdowson (1965) は *Laminaria* に，Kajimura (1981) は *Streptophyllopsis* とした。詳しい検討が必要である。

(36) f. *linearis*, f. *latior*, f. *ovata*, var. *crispata* が区別された（岡村 1936)。

(37) f. *angustifolia* ホソバオニコンブ，f. *longipes* エナガオニコンブが区別される (Nagai 1940, 岡村 1936)。

(38) f. *membranacea* ドテメが記載されている（岡村 1936)。

(39) Kawai and Kurogi (1985) によりコンブ目の新しい科とされ，最近 Kawai and Nabata (1990) により北海道西岸から 1 種が加えられた。

(40) 異名は川井・山田 (1990) の意見による。Henry (1984) は生活史の研究から目のレベルで独立させることを提唱した。

(41) *Neurocarpus, Haliseris* は *Dictyopteris* の異名。

(42) 異名は Silva, Meñez and Moe (1987) による。

(43) *D. naevosa* は Yendo (1909) の報告後，記録がなく実体不明。

(44) *D. radicans* ヒメフクリンは *Padina* 属のものの基部構造である。

(45) var. *cuneata* キレバノウスバウミウチワ (Tanaka and Nozawa 1962) が記載されている。

(46) 異名は Silva, Meñez and Moe (1987) による。

(47) 異名は Yoshida and Kawai (1987) による。

(48) f. *babingtonii*, f. *japonica* が記載されたが，区別する必要はないと思われる。

(49) f. *clavigera*, f. *cylindrica*, f. *foliifera*, f. *liniformis* が記載されている（岡村 1936)。

(50) Yendo (1907) が記録した *S. aquifolium*, *S. cer-*

vicorne (=*cinctum* sensu YENDO), *S. gracillimum, S. graminifolium, S. heterocystum, S. latifolium* はその後確認されておらず，実体不明。
(51) 異名は野呂・南波 (1990) による。
(52) 大葉・有賀 (1982) が石垣島から記録した。
(53) f. *schizophyllum* が区別された（岡村 1936)。
(54) var. *patula,* var. *pinnatifolium,* var. *serratifolium* キレバノマメタワラが区別された（山田 1942)。
(55) 鯵坂・KILAR (1990) が沖縄県から報告した。

RHODOPHYCEAE RABENHORST, 1863 紅藻綱
(BANGIOPHYCEAE CRONQUIST, 1960)

PORPHYRIDIALES KYLIN, 1937 ちのりも目
Goniotrichaceae G. M. SMITH, 1933 べにみどろ科
Asterocytis GOBI ex SCHMITZ in ENGLER et PRANTL, 1896 アステロキティス属
echigoensis NODA えちごたまのいと (1)
Bangiopsis SCHMITZ in ENGLER et PRANTL, 1896 にせうしけのり属
subsimplex (MONTAGNE) SCHMITZ in ENGLER et PRANTL にせうしけのり
[*Goniotrichum humphreyi* sensu TANAKA]
Chroodactylon HANSGIRG, 1885 たまつなぎ属
ornatum (C. AGARDH) BASSON たまつなぎ
[*Asterocytis ornata*]
Colacodictyon FELDMANN, 1955 あみまゆだま属
reticulatum (BATTERS) J. FELDMANN あみまゆだま
[*Colaconema reticulatum*]
Stylonema REINSCH, 1874–1875 べにみどろ属 (2)
alsidii (ZANARDINI) DREW べにみどろ
[*elegans*]
[*Goniotrichum alsidii*]
cornu-cervi REINSCH かずのほしのいと
[*Goniotrichum cornu-cervi*]

Porphyridiaceae KYLIN ex SKUJA, 1939 ちのりも科 (3)
Rhodella EVANS, 1970 ロデラ属
* *maculata* EVANS
* *reticulata* DEASON, BUTLER et RHYNE
* *violacea* (KORNMANN) WEHRMEYER
Rhodosorus GEITLER, 1930 ロドソルス属
* *marinus* GEITLER
Rhodospora GEITLER, 1927 ロドスポラ属
* *sordida* GEITLER

ERYTHROPELTIDALES GARBARY, HANSEN et SCAGEL, 1980 エリスロペルティス目
Erythropeltidaceae SKUJA, 1939 エリスロペルティス科
Erythrocladia ROSENVINGE, 1909 いそはなび属
irregularis ROSENVINGE いそはなび
[*subintegra*]
Erythrotrichia ARESCHOUG, 1850 nom. cons. ほしのいと属
carnea (DILLWYN) J. AGARDH ほしのいと (4)
[*biseriata*]
[*reflexa*]
filibasalis NODA あしぼそいとまくら
[*pulvinata* NODA et HONDA]
incrassata TANAKA いそりぼん
japonica TOKIDA ほしのおび
[*Bangia ciliata*]
parietalis TANAKA いとりぼん
regularis NODA せいれつほしのおび
sargassicola NODA もくつきほしのおび
Porphyropsis ROSENVINGE, 1909 ひなのり属
coccinea (J. AGARDH ex ARESCHOUG) ROSENVINGE ひなのり

BANGIALES SCHMITZ in ENGLER, 1892 うしけのり目
Bangiaceae ENGLER, 1892 うしけのり科
Bangia LYNGBYE, 1819 うしけのり属
atropurpurea (ROTH) C. AGARDH うしけのり
[*fuscopurpurea*]
gloiopeltidicola TANAKA ふのりのうしげ
Porphyra C. AGARDH, 1824 nom. cons. あまのり属 (5)
akasakae MIURA むろねあまのり
amplissima (KJELLMAN) SETCHELL et HUS in HUS べにたさ (6)
angusta OKAMURA et UEDA in UEDA こすじのり (7)
crassa UEDA あつばあまのり
crispata KJELLMAN (sensu UEDA) つくしあまのり
dentata KJELLMAN おにあまのり
irregularis FUKUHARA えりもあまのり
ishigecola MIURA べんであまのり
katadae MIURA そめわけあまのり
kinositae (YAMADA et TANAKA) FUKUHARA うたすつ

のり
kuniedae KUROGI まるばあさくさのり
lacerata MIURA やぶれあまのり
moriensis OHMI かやべのり
occidentalis SETCHELL et HUS in HUS きいろたさ
ochotensis NAGAI あなあまのり (8)
[*perforata* sensu YENDO]
okamurae UEDA くろのり
onoi UEDA おおののり
[*abyssicola* sensu UEDA]
pseudocrassa YAMADA et MIKAMI in MIKAMI まくれあまのり
pseudolinearis UEDA うっぷるいのり
punctata YAMADA et MIKAMI in MIKAMI すなごあまのり
purpurea (ROTH) C. AGARDH ちしまくろのり
[*umbilicalis* auct. japon.]
seriata KJELLMAN いちまつのり
suborbiculata KJELLMAN まるばあまのり (9)
tanegashimensis SHINMURA たねがしまあまのり
tenera KJELLMAN あさくさのり (10)
tenuipedalis MIURA かいがらあまのり
variegata (KJELLMAN) KJELLMAN in HUS ふいりたさ
[*tenuitasa*]
[*uedae*]
yezoensis UEDA すさびのり (11)

NEMALIALES (=NEMALIONALES) SCHMITZ in ENGLER, 1892 うみぞうめん目

Acrochaetiaceae FRITSCH ex W. R. TAYLOR, 1957 アクロケチウム科 (12)
[Audouinellaceae WOELKERLING, 1971]
[Rhodochortaceae NASR, 1947]

Acrochaetium NÄGELI, 1862 アクロケチウム属 (13)
sargassicaulinus NODA in NODA et KITAMI
* *scinaiae* DAWSON (14)
toyamense NODA et HONDA in NODA et KITAMI

Audouinella BORY, 1823 オーデュイネラ属 (15)
alariae (JÓNSSON) WOELKERLING
attenuata (ROSENVINGE) GARBARY
[*Rhodochorton attenuatum*]
callithamnionoides (NAKAMURA) GARBARY
[*Rhodochorton callithamnionoides*]
**catenulata* (HOWE) GARBARY (16)
codicola (BØRGESEN) GARBARY
[*Rhodochorton codicola*]
codii (CROUAN frat.) GARBARY
[*Rhodochorton codii*]
daviesii (DILLWYN) WOELKERLING
[*Rhodochorton daviesii*]
densa (DREW) GARBARY
[*Rhodochorton densum*]
[*arcuatum*]
howei (YAMADA) GARBARY みるのべに
[*Acrochaetium howei*]
[*Rhodochorton affine* YAMADA]
[*Rhodochorton howei*]
* *humilis* (ROSENVINGE) GARBARY (16)
hyalosiphoniae (NAKAMURA) GARBARY
[*Rhodochorton hyalosiphoniae*]
immersa (ROSENVINGE) SOUTH et TITTLEY
[*Acrochaetium immersum*]
[*Chantransia immersa*]
infestans (HOWE et HOYT) DIXON in PARKE et DIXON
[*Rhodochorton infestans*]
japonica (PAPENFUSS) GARBARY べにまゆだま
[*Acrochaetium japonicum*]
[*Colaconema simplex*]
kurogii Y. P. LEE et LINDSTROM はねべにのいと
* *macropus* (KYLIN) GARBARY (16)
microscopica (NÄGELI in KÜTZING) WOELKERLING
[*crassipes*]
[*moniliformis*]
occidentalis (BØRGESEN) GARBARY
plumosa (DREW) GARBARY
[*Rhodochorton plumosum*]
polyspora (HOWE) GARBARY
purpurea (LIGHTFOOT) WOELKERLING
[*Rhodochorton purpureum*]
[*Rhodochorton rothii*]
radiata JAO
rhizoidea (DREW) GARBARY
robusta (BØRGESEN) GARBARY
[*Rhodochorton robustum*]
ryukyuensis (NAKAMURA) GARBARY
[*Rhodochorton ryukyuensis*]
sanctae-thomae (BØRGESEN) GARBARY
[*Rhodochorton sanctae-thomae*]
secundata (LYNGBYE) WOELKERLING
[*Chantransia secundata*]

seriata (BØRGESEN) GARBARY
sessilis (NAKAMURA) GARBARY
[*Rhodochorton sessile*]
subimmersum (SETCHELL et GARDNER) GARBARY et RUENESS
[*Rhodochorton subimmersum*]
terminalis (NAKAMURA) GARBARY
[*Kylinia terminalis*]
[*Rhodochorton terminale*]
Colaconema BATTERS, 1896 べにまゆだま属
furcata TANAKA よなくにまゆだま
Liagorophila YAMADA, 1944 リアゴロフィラ属 (17)
endophytica YAMADA
Rhodochorton NÄGELI, 1862 ロドコルトン属 (13)
membranaceum (MAGNUS) HAUCK
**spetsbergense* (KJELLMAN) KJELLMAN (16)
Rhodochortonopsis YAMADA, 1944 かいめんしばり属
spongicola YAMADA かいめんしばり

Bonnemaisoniaceae SCHMITZ in ENGLER, 1892 かぎけのり科 (18)

Asparagopsis MONTAGNE in WEBB et BERTHELOT, 1841 かぎけのり属
taxiformis (DELILE) TREVISAN かぎけのり (19)
[*sanfordiana*]
Bonnemaisonia C. AGARDH, 1822 かぎのり属
hamifera HARIOT かぎのり (20)
[*Asparagopsis hamifera*]
Delisea LAMOUROUX, 1819 たまいただき属
japonica OKAMURA たまいただき (21)
[*fimbriata* auct. japon.]
[*pulchra* auct. japon.]
Ptilonia (HARVEY) J. AGARDH, 1852 ひろはたまいただき属 (22)
okadae YAMADA ひろはたまいただき
[*Delisea okadae*]

Dermonemataceae (SCHMITZ et HAUPTFLEISCH) ABBOTT, 1976 かさまつ科

Dermonema HARVEY ex HEYDRICH, 1894 かさまつ属
divaricatum OKAMURA et SEGAWA in OKAMURA しまかさまつ
frappieri (MONTAGNE et MILLARDET) BØRGESEN かさまつ
[*gracile*]
pulvinatum (GRUNOW in HOLMES) FAN かもがしらのり
[*Nemalion pulvinatum*]
Patenocarpus YOSHIZAKI, 1987 パテノカルプス属 (23)
* *paraphysiferus* YOSHIZAKI
Yamadaella ABBOTT, 1970 はいこなはだ属
caenomyce (DECAISNE) ABBOTT はいこなはだ
[*Liagora annulata* sensu YENDO]
[*Liagora caenomyce*]
[*Liagora rugosa*]

Galaxauraceae PARKINSON, 1983 がらがら科
[Chaetangiaceae KÜTZING, 1843]

Actinotrichia DECAISNE, 1842 そでがらみ属
fragilis (FORSSKÅL) BØRGESEN そでがらみ
[*rigida*]
robusta ITONO しまそでがらみ
Galaxaura LAMOUROUX, 1812 がらがら属 (24)
apiculata KJELLMAN ぎぼうしがらがら
articulata TANAKA くだがらがら
clavigera KJELLMAN あつばがらがら
contigua KJELLMAN
cuculligera KJELLMAN つくしがらがら
cylindrica (SOLANDER) LAMOUROUX
delabida KJELLMAN もつれがらがら
elongata J. AGARDH ながらがら
falcata KJELLMAN ひらがらがら
fasciculata KJELLMAN びろうどがらがら
fastigiata DECAISNE がらがら
filamentosa CHOU in TAYLOR ふさがらがら
[*rudis*]
glabriuscula KJELLMAN つやがらがら
hystrix KJELLMAN へらがらがら
kjellmanii WEBER VAN BOSSE さめはだがらがら
oblongata (ELLIS et SOLANDER) LAMOUROUX なんきがらがら
obtusata (ELLIS et SOLANDER) LAMOUROUX ふくろがらがら
pacifica TANAKA ちゃぼがらがら
papillata KJELLMAN ぱぴらがらがら
pilifera KJELLMAN
robusta KJELLMAN じゅずがらがら
stupocaula KJELLMAN ほそばがらがら (25)
[*arborea*]
subfruticulosa CHOU in TAYLOR もさがらがら

[*fruticulosa*]
subverticillata KJELLMAN しまがらがら
ventricosa KJELLMAN うすゆきがらがら (26)
[*yaeyamensis*]
verprecula KJELLMAN うすばがらがら
yamadae ITONO
Scinaia BIVONA-BERNARDI, 1822 ふさのり属
* *flabellata* KAJIMURA (27)
japonica SETCHELL ふさのり
latifrons HOWE ひらふさのり
[*cottonii*]
moniliformis J. AGARDH じゅずふさのり
okamurae (SETCHELL) HUISMAN にせふさのり (28)
[*Gloiophloea okamurai*]
* *okiensis* KAJIMURA (27)
* *tokidae* KAJIMURA (27)

Helminthocladiaceae J. AGARDH, 1851 べにもずく科
[Nemalionaceae (FARLOW) DE TONI et LEVI, 1886]
Helminthocladia J. AGARDH, 1851 nom. cons. べにもずく属
australis HARVEY べにもずく
macrocephala YAMADA しまべにもずく
yendoana NARITA ほそべにもずく
Liagora LAMOUROUX, 1812 こなはだ属
boergesenii YAMADA すじこなはだ
boninensis YAMADA ぼうにんこなはだ
ceranoides LAMOUROUX
f. *leprosa* (J. AGARDH) YAMADA あおこなはだ
[*leprosa*]
f. *pulverulenta* (C. AGARDH) YAMADA こなはだ
clavata YAMADA ふくれこなはだ
farinosa LAMOUROUX けこなはだ
[*cheyneana*]
[*Ganonema farinosa*]
hawaiiana BUTTERS
japonica YAMADA よごれこなはだ
[*cliftoni* sensu YENDO]
mucosissima YAMADA ぬるはだ
orientalis J. AGARDH ふさこなはだ
papenfussii ABBOTT はねこなはだ
[*pinnata* sensu YAMADA]
robusta YAMADA たちこなはだ
segawae YAMADA みぞこなはだ
setchellii YAMADA いしはだ
[*valida* sensu OKAMURA]
tanakae ABBOTT
Liagoropsis YAMADA, 1944 にせこなはだ属
yamadae OHMI et ITONO
Nemalion DUBY, 1830 うみぞうめん属
multifidum (WEBER et MOHR) J. AGARDH つくものり (29)
vermiculare SURINGAR うみぞうめん
Trichogloea KÜTZING, 1847 あけぼのもずく属
papenfussii TANAKA よごれあけぼのもずく
requienii (MONTAGNE) KÜTZING あけぼのもずく
[*lubrica*]
subnuda HOWE

GELIDIALES KYLIN, 1923 てんぐさ目
Gelidiaceae KÜTZING, 1843 てんぐさ科
Acanthopeltis OKAMURA in YATABE, 1892 ゆいきり属
japonica OKAMURA in YATABE ゆいきり
Gelidium LAMOUROUX, 1813 nom. cons. てんぐさ属 (30)
amamiense TANAKA et K. NOZAWA in TANAKA しんかいひめぶと
decumbensum OKAMURA たおれぐさ
divaricatum MARTENS ひめてんぐさ
elegans KÜTZING まくさ (31)
[*amansii* auct. japon.]
isabelae TAYLOR へらひめぶと
japonicum (HARVEY) OKAMURA おにくさ (32)
[*Onikusa japonica*]
johnstonii SETCHELL et GARDNER つやくさ
linoides KÜTZING きぬくさ
nanum INAGAKI ひめひら
pacificum OKAMURA おおぶさ
polystichum GARDNER えぞてんぐさ
pulchrum GARDNER ささめぶと
purpurascens GARDNER むらさきぶと
pusillum (STACKHOUSE) LE JOLIS はいてんぐさ (33)
[*crinale* いとてんぐさ]
pyramidale GARDNER ながとぶと
subfastigiatum OKAMURA なんぶぐさ
tenue OKAMURA こひら
vagum OKAMURA よれくさ
yamadae FAN こぶさ

[*densum* OKAMURA]

Pterocladia J. AGARDH, 1852 おばくさ属

capillacea (GMELIN) BORNET in BORNET et THURET おばくさ

[*tenuis*]

densa OKAMURA かたおばくさ

nana OKAMURA ちゃぼおばくさ

Ptilophora KÜTZING, 1847 ひらくさ属 (34)

irregularis (AKATSUKA et MASAKI) NORRIS ながひらくさ

[*Beckerella irregularis*]

subcostata (OKAMURA in SCHMITZ) NORRIS ひらくさ

[*Beckerella subcostata*]

[*Gelidium subcostatum*]

Yatabella OKAMURA, 1900 やたべぐさ属

hirsuta OKAMURA やたべぐさ

Gelidiellaceae FAN, 1961 しまてんぐさ科

Gelidiella FELDMANN et HAMEL, 1934 しまてんぐさ属

acerosa (FORSSKÅL) FELDMANN et HAMEL しまてんぐさ

ramellosa (KÜTZING) FELDMANN et HAMEL きっこうしまてんぐさ

CRYPTONEMIALES SCHMITZ in ENGLER, 1892 かくれいと目

Choreocolacaceae STURCH, 1926 コレオコラックス科

Gelidiocolax GARDNER, 1927 てんぐさやどり属

mammillata FAN et PAPENFUSS てんぐさやどり

Leachiella KUGRENS, 1982 はねぐさやどり属

* *pacifica* KUGRENS はねぐさやどり (35)

Corallinaceae LAMOUROUX, 1812 さんごも科 (36)

Amphiroa LAMOUROUX, 1812 かにのて属

* *anastomosans* WEBER VAN BOSSE (37)

dilatata LAMOUROUX かにのて

echigoensis YENDO えちごかにのて

ephedraea (LAMARCK) DECAISNE まおうかにのて

* *foliacea* LAMOUROUX (37)

fragilissima (LINNAEUS) LAMOUROUX

* *itonoi* SRIMANOBHAS et MASAKI いとかがり (38)

misakiensis YENDO ひめかにのて

pusilla YENDO ひなかにのて

rigida LAMOUROUX いそはり

valonioides YENDO いそはりがね

yendoi DE TONI みぞかにのて

zonata YENDO うすかわかにのて

[*beauvoisii*]

Bossiella SILVA, 1957 いそきり属

cretacea (POSTELS et RUPRECHT) JOHANSEN いそきり

[*Amphiroa cretacea*]

Calliarthron MANZA, 1937 えぞしころ属 (39)

latissimum (YENDO) MANZA

[*Cheilosporum latissimum*]

modestum (YENDO) MANZA やはずしころ

[*Alatocladia modesta*]

[*Cheilosporum anceps* var. *modestum*]

yessoense (YENDO) MANZA えぞしころ

[*Cheilosporum yessonese*]

Cheilosporum (DECAISNE) ZANARDINI, 1844 ひめしころ属 (40)

acutilobum (DECAISNE) PICCONE ひめしころ

[*jungermannioides*]

* *spectabile* HARVEY ex GRUNOW はねひめしころ

Choreonema SCHMITZ, 1889 いしいぼ属

thuretii (BORNET) SCHMITZ

Clathromorphum FOSLIE, 1898 きたいしも属

circumscriptum (STRÖMFELT) FOSLIE きたいしも

compactum (KJELLMAN) FOSLIE あなあききたいしも

Corallina LINNAEUS, 1758 さんごも属

confusa YENDO みやひば (41)

[*squamata* auct. japon.]

officinalis LINNAEUS さんごも

pilulifera POSTELS et RUPRECHT ぴりひば (42)

[*kaifuensis* ひめひば]

sessilis YENDO みやひばもどき

Ezo ADEY, MASAKI et AKIOKA, 1974 しずくいしごろも属

epiyessoense ADEY, MASAKI et AKIOKA しずくいしごろも

Fosliella HOWE in BRITTON et MILLSPAUGH, 1920 いぼもかさ属

farinosa (LAMOUROUX) HOWE いぼもかさ

paschalis (LEMOINE) SETCHELL et GARDNER いぼもかさもどき

Goniolithon FOSLIE, 1898 いしのみ属

mamillare (HARVEY) FOSLIE いぼいしも

propinquum (FOSLIE) FOSLIE

versabile FOSLIE

Jania Lamouroux, 1812 もさずき属
adhaerens Lamouroux ひめもさずき
[*decussato-dichotoma*]
arborescens (Yendo) Yendo きぶりもさずき
capillacea Harvey けひめもさずき
nipponica (Yendo) Yendo うらもさずき
pumila Lamouroux
radiata Yendo ひおうぎ
rubens (Linnaeus) Lamouroux
tenella (Kützing) Grunow
ungulata (Yendo) Yendo さきびろもさずき
yenoshimensis (Yendo) Yendo
Leptophytum Adey, 1966 レプトフィツム属
laeve (Foslie) Adey いしも
[*Lithothamnion laeve* f. *tenue*]
Lithophyllum Philippi, 1837 いしごろも属
absimile Foslie et Howe in Foslie いわのさび
acanthinum Foslie
amplexifrons (Harvey) Heydrich くさのかきもどき
* *balmeri* (Heydrich) Heydrich ひらたいしも (43)
caribaeum (Foslie) Foslie
f. *boreale* Masaki きたにせうみさびもどき
fasciculatum (Lamarck) Foslie かのこもち
grumosum (Foslie) Foslie
* *kotschyanum* Unger みなみいしも (43)
* *moluccense* (Foslie) Foslie もるっかいしも (43)
neoatalayense Masaki くぼみいしごろも
okamurae Foslie ひらいぼ
racemus (Lamarck) Foslie
samoense Foslie さもあいしごろも
shioense Foslie みさきいしごろも
tortuosum (Esper) Foslie はちのすいし
yendoi (Foslie) Foslie うみさび
yessoense Foslie えぞいしごろも
Lithothamnion Heydrich, 1897 nom. cons. いしも属 (44)
aculeiferum Mason in Setchell et Mason せといしも
canariense Foslie かなりあいしも
cystocarpideum Foslie くさのかき
erubescens Foslie
f. *madagascarensis* Foslie えだうちいしも
glaciale Kjellman
intermedium Kjellman
japonicum Foslie みやべおこし
[*fretense* かいふおこし]
lenormandii (Areschoug) Foslie あっけしいしも
membranaceum (Esper) Foslie
nitidum Foslie
notatum Foslie
obtectulum (Foslie) Foslie あっけしおこし
pacificum (Foslie) Foslie あっけしいぼいし
siamense Foslie
simulans (Foslie) Foslie in Weber van Bosse et Foslie かわらいしも
sonderi Hauck いぼおこし
spissum Foslie
vescum Foslie ひらおこし
Marginisporum (Yendo) Ganesan, 1968 へりとりかにのて属
aberrans (Yendo) Johansen et Chihara in Johansen ふさかにのて
[*Amphiroa aberrans*]
crassissima (Yendo) Ganesan へりとりかにのて
[*Amphiroa crassissima*]
declinata (Yendo) Ganesan まがりかにのて
[*Amphiroa declinata*]
Mastophora Decaisne, 1842 いしのはな属
pacifica (Heydrich) Foslie こしかいしも
[*Lithoporella melobesioides* sensu Masaki]
rosea (C. Agardh) Setchell いしのはな
[*macrocarpa*]
Melobesia Lamouroux, 1812 さび属
pacifica Masaki あばたもかさ
Mesophyllum Lemoine, 1928 えだうちいしも属
nitidum (Foslie) Adey
Neogoniolithon Setchell et Mason, 1943 いしみのもどき属
accretum (Foslie et Howe) Setchell et Mason りなきいしも
* *fosliei* (Heydrich) Setchell et Mason ふぉずりーいしも (43)
misakiense (Foslie) Setchell et Mason かさねいしも
[*Goniolithon misakiense*]
pacificum (Foslie) Setchell et Mason すりばちいしも
[*Goniolithon pacificum*]
Neopolyporolithon Adey et Johansen, 1972 かさきのこいしも属

reclinatum (FOSLIE) ADEY et JOHANSEN かさきのこいしも
Paragoniolithon ADEY, TOWNSEND et BOYKINS, 1952 パラゴニオリトン属 (45)
* *conicum* (DAWSON) ADEY, TOWNSEND et BOYKINS
Pneophyllum KÜTZING, 1843 もかさ属 (46)
confervicola (KÜTZING) CHAMBERLAIN ひめもかさ
[*Fosliella minutula*]
lejolisii (ROSANOFF) CHAMBERLAIN しろもかさ
[*Fosliella lejolisii*]
sargassi (FOSLIE) CHAMBERLAIN もくごろも
[*Heteroderma sargassi*]
zostericolum (FOSLIE) FUJITA もかさ
[*Fosliella zostericola*]
[*Heteroderma zostericola*]
Porolithon (FOSLIE) FOSLIE, 1909 あなあきいしも属
boergesenii (FOSLIE) LEMOINE in BØRGESEN せといぼいし
colliculosum MASAKI とげいぼ
onkodes (HEYDRICH) FOSLIE あなあきいしも
orbiculatum MASAKI おにはすいしも
Pseudolithophyllum LEMOINE, 1913 シュードリトフィルム属
decipiens (FOSLIE) STENECK et PAINE うみさびもどき
[*Hydrolithon decipiens*]
neofarlowii (SETCHELL et MASON) ADEY こぶいしごろも
Serraticardia (YENDO) SILVA, 1957 おおしころ属
maxima (YENDO) SILVA おおしころ
[*Cheilosporum maximum*]
[*Joculator maximus*]
Spongites KÜTZING, 1841 こぶいしも属 (47)
reinboldii (WEBER VAN BOSSE et FOSLIE) PENROSE et WOELKERLING こぶいしも
[*Hydrolithon reinboldii*]
Sporolithon HEYDRICH, 1897 スポロリトン属
schmidtii (FOSLIE) GORDON, MASAKI et AKIOKA
Titanoderma NÄGELI, 1858 のりまき属 (48)
canescens (FOSLIE) WOELKERLING, CHAMBERLAIN et SILVA そうはん
[*Dermatolithon canescens*]
[*Lithophyllum canescens*]
corallinae (CROUAN frat.) WOELKERLING, CHAMBERLAIN et SILVA ひめごろも
[*Tenarea corallinae*]
dispar (FOSLIE) WOELKERLING, CHAMBERLAIN et SILVA のりまきもどき
[*Tenarea dispar*]
pustulatum (LAMOUROUX) NÄGELI
[*Lithophyllum pustulatum*]
* *tessellatum* (LEMOINE) WOELKERLING, CHAMBERLAIN et SILVA うずまきしろぶち (49)
tumidulum (FOSLIE) WOELKERLING, CHAMBERLAIN et SILVA のりまき
[*Dermatolithon tumidulum*]
[*Lithophyllum tumidulum*]
[*Tenarea tumidulum*]
Yamadaea SEGAWA, 1955 さびもどき属
melobesioides SEGAWA さびもどき

Dumontiaceae BORY, 1828 りゅうもんそう科 (50)
Constantinea POSTELS et RUPRECHT, 1840 おきつばら属
rosa-marina (GMELIN) POSTELS et RUPRECHT おきつばら
subulifera SETCHELL おおばおきつばら
Dudresnaya CROUAN frat., 1835 nom. cons. ひびろうど属
japonica OKAMURA ひびろうど
minima OKAMURA ひめひびろうど (51)
Dumontia LAMOUROUX, 1813 りゅうもんそう属
contorta (GMELIN) RUPRECHT りゅうもんそう
[*filiformis*]
[*incrassata*]
simplex COTTON へらりゅうもん
Gibsmithia DOTY, 1963 えつきひびろうど属
hawaiiensis DOTY えつきひびろうど (52)
Hyalosiphonia OKAMURA, 1909 いそうめもどき属
caespitosa OKAMURA いそうめもどき
Masudaphycus LINDSTROM, 1988 にせかれきぐさ属 (53)
irregularis (YAMADA) LINDSTROM にせかれきぐさ
[*Farlowia irregularis*]
Neodilsea TOKIDA, 1943 あかば属
crispata MASUDA ちぢれあかば
longissima (MASUDA) LINDSTROM ながあかば
[*integra* var. *longissima*]
tenuipes YAMADA et MIKAMI in MIKAMI まるばあかば
yendoana TOKIDA あかば
[*Dilsea edulis* auct. japon.]

Pikea HARVEY, 1853 みちがえそう属
californica HARVEY みちがえそう

Endocladiaceae (J. AGARDH) KYLIN, 1928 ふのり科 (54)
Gloiopeltis J. AGARDH, 1842 ふのり属
complanata (HARVEY) YAMADA はなふのり
furcata (POSTELS et RUPRECHT) J. AGARDH ふくろふのり (55)
tenax (TURNER) DECAISNE まふのり

Gloiosiphoniaceae SCHMITZ, 1892 いとふのり科
Gloeophycus I. K. LEE et S. A. YOO, 1979 おとひめもずく属
koreanum I. K. LEE et S. A. YOO おとひめもずく
Gloiosiphonia CARMICHAEL in BERKELEY, 1833 いとふのり属
capillaris (HUDSON) CARMICHAEL in BERKELEY いとふのり
Schimmelmannia SCHOUSBOE ex KÜTZING, 1849 ながおばね属
plumosa (SETCHELL) ABBOTT ながおばね
[*Baylesia plumosa*]

Halymeniaceae BORY, 1828 むかでのり科
Carpopeltis SCHMITZ, 1889 ちゃぼきんとき属 (56)
affnis (HARVEY) OKAMURA まつのり (57)
formosana OKAMURA
maillardii (MONTAGNE et MILLARDET) CHIANG ちゃぼきんとき
[*rigida*]
prolifera (HARIOT) KAWAGUCHI et MASUDA こめのり
[*flabellata*]
Cryptonemia J. AGARDH, 1842 かくれいと属
luxurians (C. AGARDH) J. AGARDH ひろはのかくれいと
semiprocumbens TANAKA なんかいかくれいと
yendoi WEBER VAN BOSSE うすばかくれいと
Grateloupia C. AGARDH, 1822 むかでのり属
acuminata HOLMES おおむかでのり (58)
[*Halymenia acuminata*]
carnosa YAMADA et SEGAWA in YAMADA にくむかで
divaricata OKAMURA かたのり
filicina (LAMOUROUX) C. AGARDH むかでのり (59)
gelatinosa GRUNOW ex HOLMES
imbricata HOLMES さくらのり (60)
incurvata NODA in NODA et KITAMI げじげじむかでのり
jubata YENDO
kaifuensis YENDO かいふのり
* *kurogii* KAWAGUCHI まるばふだらく (133)
latissima OKAMURA
livida (HARVEY) YAMADA ひらむかで
nipponica YENDO
okamurae YAMADA きょうのひも
[*lancifolia*]
prolongata J. AGARDH ひろはのむかでのり
sparsa (OKAMURA) CHIANG ひぢりめん
[*Cyrtymenia sparsa*]
[*Phyllymenia sparsa*]
turuturu YAMADA つるつる
Halymenia C. AGARDH, 1817 いそのはな属
dilatata ZANARDINI ふいりぐさ
durvillaei BORY
var. *formosa* (HARVEY ex KÜTZING) REINBOLD in REINECKE つづれぐさ
floresia (CLEMENTE) C. AGARDH いそのはな
iyoensis YAGI ひょうたんぐさ
rotunda OKAMURA まるばぐさ
Kintokiocolax TANAKA et Y. NOZAWA, 1960 きんときやどり属 (61)
aggregato-cerantha TANAKA et Y. NOZAWA きんときやどり
Pachymeniopsis YAMADA in KAWABATA, 1954 ふだらく属 (62)
elliptica (HOLMES) YAMADA in KAWABATA たんばのり
[*Grateloupia elliptica*]
lanceolata (OKAMURA) YAMADA in KAWABATA ふだらく
[*Aeodes lanceolata*]
Polyopes J. AGARDH, 1849 またぼう属
polyideoides OKAMURA またぼう
Prionitis J. AGARDH, 1851 nom. cons. きんとき属 (63)
angusta (HARVEY) OKAMURA きんとき
[*Carpopeltis angusta*]
articulata OKAMURA ふしきんとき
[*Carpopeltis articulata*]
cornea (OKAMURA) DAWSON つのむかで
[*Carpopeltis cornea*]
crispata (OKAMURA) KAWAGUCHI とさかまつ

[*Carpopeltis crispata*]
divaricata (OKAMURA) KAWAGUCHI ひとつまつ
[*Carpopeltis divaricata*]
elata OKAMURA ながきんとき
[*Carpopeltis okamurae*]
patens OKAMURA ひらきんとき
ramosissima (OKAMURA) KAWAGUCHI すじむかでのり
[*Grateloupia ramosissima*]
schmitziana OKAMURA おおばきんとき
[*Cryptonemia schmitziana*]

Hildenbrandiaceae ROSENVINGE, 1917 べにまだら科 (64)
Hildbrandtia NARDO, 1834 べにまだら属 (65)
rubra (SOMMERFELT) MENEGHINI べにまだら
[*prototypus*]
[*rosea*]
yessoensis YENDO えぞべにまだら

Kallymeniaceae W. R. TAYLOR, 1937 つかさのり科
Callophyllis KÜTZING, 1843 とさかもどき属 (66)
adhaerens YAMADA くろとさかもどき
adnata OKAMURA ねざしのとさかもどき
crispata OKAMURA ひろはのとさかもどき
cristata (C. AGARDH) KÜTZING ゆうそら
[*Euthora fruticulosa*]
hayamensis YAMADA えつきのとさかもどき
japonica OKAMURA in DE TONI et OKAMURA ほそばのとさかもどき
mageshimensis TANAKA なんかいとさかもどき
okamurae SILVA きぬはだ
[*chilensis*]
[*firma*]
[*Microcoelia chilensis*]
[*Pugetia japonica*]
palmata YAMADA やつでがたとさかもどき
rhynchocarpa RUPRECHT in MIDDENDORFF ひめとさかもどき
Cirrulicarpus TOKIDA et MASAKI, 1956 えぞとさか属
gmelini (GRUNOW) TOKIDA et MASAKI えぞとさか
[*Erythrophyllum gmelini*]
Kallymenia J. AGARDH, 1842 つかさのり属
callophylloides OKAMURA et SEGAWA in SEGAWA はながたかりめにあ
crassiuscula OKAMURA あつばかりめにあ
oligonema YAMADA ひめつかさのり
ornata (POSTELS et RUPRECHT) J. AGARDH きたつかさのり
perforata J. AGARDH つかさあみ
reniformis (TURNER) J. AGARDH
var. *cuneata* J. AGARDH えぞつかさのり
sagamiana YAMADA おおつかさのり
sessilis OKAMURA えなしかりめにあ
stipitata OKAMURA えつきつかさのり

Peyssonneliaceae DENIZOT, 1968 いわのかわ科
[Squamariaceae J. AGARDH, 1851]
Cruoriella CROUAN frat., 1859 いわげしょう属
fissurata DAWSON さけめいわげしょう
[*Peyssonnelia mariti*]
Peyssonnelia DECAISNE, 1841 いわのかわ属
caulifera OKAMURA えつきいわのかわ
conchicola PICCONE et GRUNOW in PICCONE べにいわのかわ
[*rubra* sensu YENDO]
distenta (HARVEY) YAMADA くだいわのかわ
dubyi CROUAN frat.
japonica (SEGAWA) YONESHIGUE かいのかわ
[*Cruoriopsis japonica*]
orientalis (WEBER VAN BOSSE) CORMACI et FURNARI あかぜいわのかわ

Tichocarpaceae (SCHMITZ et HAUPTFLEISCH) KYLIN, 1928 かれきぐさ科
Tichocarpus RUPRECHT in MIDDENDORFF, 1851 かれきぐさ属
crinitus (GMELIN) RUPRECHT in MIDDENDORFF かれきぐさ

Insertae sedis 位置不明
Ethelia (WEBER VAN BOSSE) WEBER VAN BOSSE, 1921 にくいわのかわ属
biradiata (WEBER VAN BOSSE) WEBER VAN BOSSE にくいわのかわ

AHNFELTIALES MAGGS et PUESHEL, 1989 さいみ目
Ahnfeltiaceae MAGGS et PUESHEL, 1989 さいみ科
Ahnfeltia E. M. FRIES, 1835 さいみ属

concinna J. Agardh さいみ
fastigiata (Endlicher) Makijenko ねつきいたにぐさ (67)
[*plicata* auct. japon.]
furcellata Okamura ふささいみ
gracilis (Yamada) Yamada et Mikami in Mikami べさ
[*Besa gracilis*]
yamadae (Segawa) Mikami はねさいみ

GIGARTINALES Schmitz in Engler, 1892 すぎのり目

Calosiphoniaceae Kylin, 1932 ぬめりぐさ科
Calosiphonia Crouan frat., 1852 ぬめりぐさ属
vermicularis (J. Agardh) Schmitz ぬめりぐさ
Schmitzia Silva, 1959 ほうのお属
japonica (Okamura) Silva ほうのお
[*Bertholdia japonica*]
[*Platoma japonica*]

Caulacanthaceae Kützing, 1843 いそもっか科
[Rhabdoniaceae Kylin, 1925]
Catenella Greville, 1830 nom. cons. いそもっか属
caespitosa (Withering) Irvine in Parke et Dixon いそもっか
[*opuntia*]
[*repens*]
impudica (Montagne) J. Agardh
nipae Zanardini
Caulacanthus Kützing, 1843 いそだんつう属
compressus Harvey (68)
okamurae Yamada いそだんつう

Furcellariaceae Greville, 1830 すすかけべに科
Halarachnion Kützing, 1843 すすかけべに属
latissimum Okamura すすかけべに
parvum Yamada こばのすすかけべに
Neurocaulon Zanardini ex Kützing, 1849 じんようのり属
japonicum Segawa じんようのり

Gigartinaceae Bory, 1828 すぎのり科
Chondrus Stackhouse, 1797 つのまた属
elatus Holmes ことじつのまた (69)
giganteus Yendo おおばつのまた (70)
[*ocellatus* f. *giganteus*]
nipponicus Yendo まるばつのまた (71)
[*crispus* auct. japon. とちゃか, やはずつのまた]
ocellatus Holmes つのまた (72)
pinnulatus (Harvey) Okamura ひらことじ (73)
verrucosus Mikami いぼつのまた
[*ocellatus* f. *canaliculatus*]
[*Gigartina mikamii*]
yendoi Yamada et Mikami in Mikami くろはぎんなんそう (えぞつのまた) (74)
[*Iridaea laminarioides* sensu Okamura]
[*Iridophycus cornucopiae* sensu Tokida]
Gigartina Stackhouse, 1809 すぎのり属
intermedia Suringar かいのり
teedii (Roth) Lamouroux しきんのり
tenella Harvey すぎのり
[*Chondrus filiformis* いとつのまた]
Rhodoglossum J. Agardh, 1876 あかばぎんなんそう属
hemisphaericum Mikami いぼぎんなん (75)
japonicum Mikami あかばぎんなんそう (76)
[*Gigartina japonica*]
[*Iridaea pulchra* sensu Okamura]

Gracilariaceae Nägeli, 1847 nom. cons. おごのり科 (77)
Ceratodictyon Zanardini, 1878 かいめんそう属
spongiosum Zanardini かいめんそう
Congracilaria Yamamoto, 1986 コングラシラリア属
* *babae* Yamamoto (78)
Gelidiopsis Schmitz, 1895 てんぐさもどき属
gracilis (Kützing) Vickers
hachijoensis Yamada et Segawa はちじょうてんぐさもどき
intricata (C. Agardh) Vickers もつれてんぐさもどき
repens (Kützing) Schmitz てんぐさもどき
Gracilaria Greville, 1830 nom. cons. おごのり属 (79)
arcuata Zanardini ゆみがたおごのり
asiatica Zhang et Xia おごのり (80)
[*confervoides*]
[*verrucosa*]
blodgettii Harvey くびれおごのり
bursa-pastoris (Gmelin) Silva しらも

[*compressa*]
chorda HOLMES つるしらも
[*Gracilariopsis chorda*]
coronopifolia J. AGARDH もさおごのり
cuneifolia (OKAMURA) LEE et KUROGI きぬかばのり
[*Rhodymenia cuneifolia*]
edulis (GMELIN) SILVA かたおごのり
[*lichenoides*]
eucheumoides HARVEY りゅうきゅうおごのり
gigas HARVEY おおおごのり
incurvata OKAMURA みぞおごのり
punctata (OKAMURA) YAMADA いつつぎぬ
[*Rhodymenia punctata*]
salicornia (C. AGARDH) DAWSON ふしくれのり (81)
[*crassa* たいわんおごのり，ときだふしくれのり]
[*Corallopsis opuntia*]
spinulosa (OKAMURA) CHANG et XIA
f. *srilankia* CHANG et XIA むらさきかばのり
[*purpurascens*]
textorii (SURINGAR) HARIOT かばのり
vermiculophylla (OHMI) PAPENFUSS おごもどき
[*Gracilariopsis vermiculophylla*]
vieillardii SILVA とげかばのり
[*denticulata* WEBER VAN BOSSE]
Tylotus J. AGARDH, 1876 なみいわたけ属
lichenoides OKAMURA なみいわたけ

Hypneaceae J. AGARDH, 1851 いばらのり科
Hypnea LAMOUROUX, 1813 いばらのり属
cenomyce J. AGARDH おおこけいばら
cervicornis J. AGARDH かずのいばら
charoides LAMOUROUX いばらのり
[*seticulosa*]
chordacea KÜTZING
f. *simpliciuscula* (OKAMURA) TANAKA こひもいばら
cornuta (KÜTZING) J. AGARDH ほしがたいばらのり
esperi BORY ひめいばらのり
flagelliformis J. AGARDH すじいばらのり
japonica TANAKA かぎいばらのり
[*musciformis* sensu OKAMURA]
pannosa J. AGARDH こけいばら
[*nidulans* むらさきこけいばら]
saidana HOLMES さいだいばら (82)
variabilis OKAMURA たちいばらのり
yamadae TANAKA べにいばらのり
Hypneocolax BØRGESEN, 1920 あねやかたのり属
stellaris BØRGESEN
f. *orientalis* WEBER VAN BOSSE あねやかたのり

Nemastomataceae SCHMITZ, 1892 nom. cons. prop. ひかげのいと科
[Gymnophlaeaceae KÜTZING, 1843]
Nemastoma J. AGARDH, 1842 orth. cons. うすぎぬ属 (83)
foliacea YAMADA ひめうすぎぬ
lancifolia OKAMURA うすぎぬ
Platoma SCHOUSBOE ex SCHMITZ, 1894 にくほうのお属
izunosimensis SEGAWA にくほうのお
Predaea G. DE TONI f., 1936 ゆるぢぎぬ属
* *bisporifera* KAJIMURA (84)
japonica YOSHIDA ゆるぢぎぬ
* *tokidae* KAJIMURA (84)
Schizymenia J. AGARDH, 1851 べにすなご属
dubyi (CHAUVIN in DUBY) J. AGARDH べにすなご
Titanophora (J. AGARDH) FELDMANN, 1942 べにざらさ属
palmata ITONO あまみのべにざらさ
weberae BØRGESEN べにざらさ
Tsengia K. C. FAN et Y. P. FAN, 1962 ひかげのいと属
nakamurae (YENDO) K. C. FAN et Y. P. FAN ひかげのいと
[*Nemastoma nakamurae*]

Petrocelidaceae DENIZOT, 1968 いぼのり科
Mastocarpus KÜTZING, 1843 いぼのり属
mamillosus (auct. japon.) いかのあし
[*Gigartina mamillosa* auct. japon.]
pacificus (KJELLMAN) PERESTENKO いぼのり (85)
[*Gigartina ochotensis* ほそいぼのり]
[*Gigartina pacifica*]
[*Gigartina unalaskensis*]

Phacelocarpaceae SEARLES, 1968 きじのお科
Phacelocarpus ENDLICHER et DIESING, 1845 nom. cons. きじのお属
japonicus OKAMURA きじのお

Phyllophoraceae RABENHORST, 1863 おきつのり科
Gymnogongrus MARTIUS, 1833 おきつのり属 (86)
* *catenatus* YENDO ほそばのひらさいみ
divaricatus HOLMES おおまたおきつのり
flabelliformis HARVEY in PERRY おきつのり
[*japonicus* そええだなしおきつ]
paradoxus SURINGAR はりがね
[*furcellatus* var. *japonicus*]
[*Ahnfeltia paradoxa*]
Stenogramma HARVEY in HOOKER et ARNOTT, 1840 はすじぐさ属
interrupta (C. AGARDH) MONTAGNE はすじぐさ

Plocamiaceae KÜTZING, 1843 ゆかり科
Plocamium LAMOUROUX, 1813 nom. cons. ゆかり属
leptophyllum (auct. japon.) ほそゆかり (87)
ovicornis OKAMURA ひめゆかり
[*oviforme*]
recurvatum OKAMURA まきゆかり
* *serrulatum* OKAMURA きざみゆかり (88)
telfairiae (HARVEY) HARVEY in KÜTZING ゆかり (89)

Polyidaceae KYLIN, 1956 ポリイデス科
Rhodopeltis HARVEY, 1863 さんごもどき属
borealis YAMADA がらがらもどき
gracilis YAMADA et TANAKA in YAMADA ほそばがらがらもどき
liagoroides YAMADA こなはだもどき
setchellii YAMADA なんばんがらがらもどき

Rhizophyllidaceae SCHMITZ in ENGLER, 1892 なみのはな科
Contarinia ZANARDINI, 1843 しおぐさごろも属
okamurae SEGAWA しおぐさごろも
Portieria ZANARDINI, 1851 なみのはな属 (90)
hornemannii (LYNGBYE) SILVA ほそばなみのはな
[*Chondrococcus hornemannii*]
japonica (HARVEY) SILVA なみのはな
[*Chondrococcus japonicus*]

Rhodophyllidaceae SCHMITZ in ENGLER, 1892 あみはだ科
Rhodophyllis KÜTZING, 1847 nom. cons. あみはだ属
capillaris TOKIDA いとあみはだ

Sarcodiaceae KYLIN, 1932 あつばのり科
Sarcodia J. AGARDH, 1852 あつばのり属
ceylanica HARVEY ex KÜTZING あつばのり
cuneifolia YAMADA ひろはあつばのり
Trematocarpus KÜTZING, 1843 みあなぐさ属
pygmaeus YENDO みあなぐさ (91)

Sebdeniaceae KYLIN, 1932 おかむらぐさ科
Sebdenia (J. AGARDH) BERTHOLD, 1884 おかむらぐさ属
flabellata (J. AGARDH) PARKINSON ぬらくさ
[*agardhii*]
[*Halymenia agardhii*]
okamurae YAMADA おかむらぐさ
polydactyla (BØRGESEN) BALAKRISHNAN くろぬらくさ
[*Halymenia polydactyla*]
yamadae OKAMURA et SEGAWA in SEGAWA やまだぐさ

Solieriaceae J. AGARDH, 1876 みりん科
Eucheuma J. AGARDH, 1847 きりんさい属
amakusaense OKAMURA あまくさきりんさい
arnoldii WEBER VAN BOSSE びゃくしんきりんさい
[*cupressoideum*]
denticulatum (BURMAN) COLLINS et HERVEY きりんさい
[*muricatum*]
gelatinum (ESPER) J. AGARDH かためんきりんさい
okamurae YAMADA おかむらきりんさい
serra (J. AGARDH) J. AGARDH とげきりんさい
striatum SCHMITZ おおきりんさい
Meristotheca J. AGARDH, 1872 とさかのり属
coacta OKAMURA きくとさか
papulosa (MONTAGNE) J. AGARDH とさかのり
[*japonica*]
Solieria J. AGARDH, 1842 みりん属 (92)
dichotoma YOSHIDA ひらみりん
pacifica (YAMADA) YOSHIDA みりん
[*robusta* auct. japon.]
tenuis ZHANG et XIA in XIA et ZHANG ほそばみりん
[*mollis* auct. japon.]
Turnerella SCHMITZ in ENGLER et PRANTL, 1896 えぞなめし属
mertensiana (POSTELS et RUPRECHT) SCHMITZ えぞなめし

Insertae sedis 位置不明

Wurdemannia HARVEY, 1853 ウルデマニア属

miniata (DUBY) FELDMANN et HAMEL

[*setacea*]

PALMARIALES GUIRY et D. IRVINE, 1978 だるす目

Palmariaceae GUIRY, 1974 だるす科

Halosaccion KÜTZING, 1843 べにふくろのり属

firmum (POSTELS et RUPRECHT) KÜTZING かたべにふくろのり（くだふくろのり）

ramentaceum (LINNAEUS) J. AGARDH ほそべにふくろのり

yendoi I. K. LEE べにふくろのり

[*saccatum* auct. japon.]

Palmaria STACKHOUSE, 1801 だるす属

marginicrassa I. K. LEE あつばだるす

palmata (LINNAEUS) O. KUNTZE だるす

[*Rhodymenia palmata*]

Pseudorhododiscus MASUDA, 1976 べにごろも属

nipponicus MASUDA べにごろも

Rhodophysema BATTERS, 1900 ふちとりべに属

elegans (CROUAN frat. ex J. AGARDH) DIXON うすふちとりべに

[*Rhododermis elegans*]

georgii BATTERS ふちとりべに

[*Rhododermis georgii*]

odonthaliae MASUDA et M. OHTA ひめふちとりべに

Rhodophysemopsis MASUDA, 1976 ふちとりべにもどき属

laminariae MASUDA ふちとりべにもどき

RHODYMENIALES SCHMITZ in ENGLER, 1892 まさごしばり目

Champiaceae KÜTZING, 1843 わつなぎそう科

[Lomentariaceae J. AGARDH, 1876]

Binghamia J. AGARDH, 1894 かえるでぐさ属

californica J. AGARDH かえるでぐさ

[*Binghamiella californica*]

Champia DESVEAUX, 1809 わつなぎそう属

bifida OKAMURA ひらわつなぎそう

echigoensis NODA えちごわつなぎそう

expansa YENDO うすばわつなぎそう

japonica OKAMURA へらわつなぎそう

parvula (C. AGARDH) HARVEY わつなぎそう

recta NODA たちわつなぎそう

Gastroclonium KÜTZING, 1843 いそまつ属

pacificum (DAWSON) CHANG et XIA いそまつ

[*ovale* sensu OKAMURA]

[*Coeloseira pacifica*]

Lomentaria LYNGBYE, 1819 ふしつなぎ属

catenata HARVEY in PERRY ふしつなぎ

flaccida TANAKA ふさふしつなぎ

hakodatensis YENDO こすじふしつなぎ

lubrica (YENDO) YAMADA いとたおやぎそう

okamurae SEGAWA ひろはふしつなぎ

[*orcadensis*]

[*rosea* sensu OKAMURA]

pinnata SEGAWA ひめふしつなぎ

Rhodymeniaceae HARVEY, 1849 まさごしばり科

Botryocladia (J. AGARDH) KYLIN, 1931 nom. cons. はなのえだ属

leptopoda (J. AGARDH) KYLIN はなのえだ

skottsbergii (BØRGESEN) LEVRING あつかわはなのえだ

[*kuckuckii*]

Chrysymenia J. AGARDH, 1842 たおやぎそう属

grandis OKAMURA おおぬらぶくろ

okamurae YAMADA et SEGAWA はなさくら

[*kairnbachii* sensu OKAMURA]

wrightii (HARVEY) YAMADA たおやぎそう

Coelarthrum BØRGESEN, 1910 ふくろつなぎ属

boergesenii WEBER VAN BOSSE すじこのり

[*coactum*]

lomentariae TANAKA et K. NOZAWA in TANAKA かたみのふくろつなぎ

muelleri (SONDER) BØRGESEN ふくろつなぎ

Coelothrix BØRGESEN, 1920 にせいばらのり属

irregularis (HARVEY) BØRGESEN にせいばらのり

Cryptarachne (HARVEY) KYLIN, 1931 ひらたおやぎ属

polyglandulosa (OKAMURA) SEGAWA ひらたおやぎ

[*Chrysymenia polyglandulosa*]

Erythrocolon (J. AGARDH) J. AGARDH, 1896 ひめふくろつなぎ属

podagrica J. AGARDH in GRUNOW ひめふくろつなぎ

Fauchea MONTAGNE et BORY in DURIEU, 1846 まだらぐさ属

leptophylla SEGAWA とげなしまだら

rhizophylla TAYLOR ひめひしがたのり（はなびまだら）

spinulosa OKAMURA et SEGAWA in SEGAWA とげまだら
stipitata YAMADA et SEGAWA in YAMADA えつきまだら
Gloioderma J. AGARDH, 1851 ひしぶくろ属
iyoense OKAMURA ひめひしぶくろ
japonicum OKAMURA ひしぶくろ
Halichrysis (J. AGARDH) SCHMITZ, 1889 ちりぼたん属
japonica SEGAWA ちりぼたん
micans (HAUPTFLEISCH in ENGLER et PRANTL) P. et H. HUVÉ うえばぐさ
[*Weberella micans*]
Rhodymenia GREVILLE, 1830 nom. cons. まさごしばり属
adnata OKAMURA かさねいつつぎぬ
coacta OKAMURA et SEGAWA in SEGAWA はながさね
intricata (OKAMURA) OKAMURA まさごしばり
liniformis OKAMURA ほそだるす
parva YAMADA ひめだるす
pertusa (POSTELS et RUPRECHT) J. AGARDH あなだるす
prostrata TANAKA しんかいひめだるす

CERAMIALES OLTMANNS, 1904 いぎす目
Ceramiaceae DUMORTIER, 1822 いぎす科
Acrothamnion J. AGARDH, 1892 りゅうのたま属
butleriae (COLLINS) KYLIN ひめくじゃくのはねも
preissii (SONDER) WOLLANSTON りゅうのたま
[*pulchellum* くじゃくはねも]
[*Antithamnion terminale*]
Aglaothamnion FELDMANN-MAZOYER, 1941 アグラオタムニオン属
cordatum (BØRGESEN) FELDMANN-MAZOYER
neglectum FELDMANN-MAZOYER
oosumiense ITONO
Anotrichium NÄGELI, 1862 きぬげぐさ属
furcellatum (J. AGARDH) BALDOCK きぬげぐさ
[*Monospora tenuis*]
[*Neomonospora furcellata*]
tenue (J. AGARDH) NÄGELI けかざしぐさ
[*Griffitsia tenuis*]
yagii (OKAMURA) BALDOCK いときぬげ
[*Monospora yagii*]
Antithamnion NÄGELI, 1847 ふたつがさね属
amamiense ITONO
antillanum BØRGESEN にせきぬいとぐさ
callocladus ITONO
cristirhizophorum TOKIDA et INABA ふさねふたつがさね
defectum KYLIN きぬいとふたつがさね
[*sparsum* くしのはふたつがさね, きぬいとよつがさね]
echigoense NODA ごせいよつがさね
nipponicum YAMADA et INAGAKI ふたつがさね
* *okiense* KAJIMURA (93)
percurrens DAWSON かたはのふたつがさね
plumula (ELLIS) THURET in LE JOLIS
secundum ITONO
tanakae ITONO とげきぬいとぐさ
Antithamnionella LYLE, 1922 ほそがさね属
basispora (TOKIDA et INABA) CORMACI et FURNARI にれつがさね
[*Antithamnion basisporum*]
elegans (BERTHOLD) PRICE et JOHN ひなふたつがさね (94)
[*breviramosa*]
[*Antithamnion breviramosum*]
spirographidis (SCHIFFNER) WOLLASTON ほそがさね (95)
[*miharae*]
[*Antithamnion gardneri* きぬいとがさね]
Balliella ITONO et TANAKA, 1973 バリエラ属
crouanioides (ITONO) ITONO et TANAKA
[*Antithamnion crouanioides*]
subcorticata (ITONO) ITONO et TANAKA なんかいべにはねも
[*Antithamnion subcorticatum*]
Callithamnion LYNGBYE, 1819 きぬいとぐさ属
aglaothamnioides ITONO
apicalis NODA たまきぬいとぐさ
callophyllidicola YAMADA きぬいとぐさ
corymbosum (SMITH) LYNGBYE
echigoense NODA えちごきぬいとぐさ
furcellariae J. AGARDH
japonicum NODA in NODA et KITAMI かまがたいとぐさ
minutissima YAMADA ひなのきぬいとぐさ
nipponicum NODA in NODA et KITAMI たんしきぬいとぐさ
Campylaephora J. AGARDH, 1851 えごのり属

crassa (OKAMURA) NAKAMURA ふといぎす (96)
[*Ceramium crassum*]
hypnaeoides J. AGARDH えごのり (97)
[*Ceramium hypnaeoides*]
japonica NODA ひめえごのり
Carpoblepharis KÜTZING, 1843 nom. cons. カルポブレファリス属
warburgii HEYDRICH おおばちりもみじ (98)
Centroceras KÜTZING, 1841 ごのめぐさ属
apiculatum YAMADA なんかいごのめぐさ
clavulatum (C. AGARDH) MONTAGNE とげいぎす
distichum OKAMURA ごのめぐさ
japonicum ITONO なんかいとげいぎす
Ceramium ROTH, 1797 nom. cons. いぎす属
aduncum NAKAMURA まきいぎす
affine SETCHELL et GARDNER
amamiense ITONO
boydenii GEPP あみくさ
ciliatum (ELLIS) DUCLUZEAU つのいぎす (99)
cimbricum H. PETERSEN in ROSENVINGE まつばらいぎす
codii (RICHARDS) MAZOYER とがりいぎす
[*mucronatum* SEGI]
fastigiramosum BOO et LEE ひめいぎす
[*fastigiatum* HARVEY]
flaccidum (HARVEY ex KÜTZING) ARDISSONE はいいぎす (100)
[*fimbriatum* ふさつきいぎす]
[*gracillimum*]
[*taylorii*]
howei WEBER VAN BOSSE なんせいいぎす
* *itonoi* ARDRÉ (101)
[*Centroceras minimum* sensu ITONO]
japonicum OKAMURA はねいぎす
kondoi YENDO いぎす
[*rubrum* sensu YENDO]
minutulum NODA et KONNO in NODA ひめはねいぎす
nakamurae DAWSON つくしいぎす
[*equisetoides* NAKAMURA]
paniculatum OKAMURA はりいぎす
procumbens SETCHELL et GARDNER
serpens SETCHELL et GARDNER
sympodiale DAWSON さでがたいぎす
tenerrimum (MARTENS) OKAMURA けいぎす
tenuicorticatum KONNO in KONNO et NODA すかしいぎす
tenuissimum (ROTH) J. AGARDH きぬいといぎす
Corynospora J. AGARDH, 1851 はいきぬげ属
sericata (SEGAWA) YOSHIDA はいきぬげ
[*Neomonospora sericata*]
Crouania J. AGARDH, 1842 よつのさで属
attenuata (C. AGARDH) J. AGARDH よつのさで
divaricata OKAMURA もさよつのさで
mageshimensis ITONO
minutissima YAMADA ひめよつのさで
Dasyphila SONDER, 1845 おきしのぶ属
plumarioides YENDO おきしのぶ
Delesseriopsis OKAMURA, 1931 うすむらさき属
elegans OKAMURA うすむらさき
Euptilota (KÜTZING) KÜTZING, 1849 いそしのぶ属
articulata (J. AGARDH) SCHMITZ いそしのぶ
Gattya HARVEY, 1855 ガッティア属
obtusa ITONO
Gordoniella ITONO, 1977 よなくにくすだま属
yonakuniensis (YAMADA et TANAKA) ITONO よなくにくすだま
[*Spermothamnion yonakuniense*]
Griffitsia C. AGARDH, 1817 かざしぐさ属
coacta OKAMURA わたげかざしぐさ
corallinoides (LINNAEUS) TREVISAN こつぶかざしぐさ
[*corallina*]
heteroclada YAMADA et HASEGAWA in HASEGAWA おくのかざしぐさ
japonica OKAMURA かざしぐさ
okiensis KAJIMURA おきかざしぐさ
rhizoidea NODA ねだしかざしぐさ
rhizophora GRUNOW ex WEBER VAN BOSSE
subcylindrica OKAMURA きぬいとかざしぐさ
tomo-yamadae OKAMURA おおかざしぐさ
venusta YAMADA たまかざしぐさ
Gymnothamnion J. AGARDH, 1892 べにはねぐさ属
elegans (SCHOUSBOE ex C. AGARDH) J. AGARDH べにはねぐさ
[*Plumaria ramosa*]
Haloplegma MONTAGNE, 1842 べにごうし属
duperreyi MONTAGNE べにごうし
Herpochondria FALKENBERG in ENGLER et PRANTL, 1897 にくさえだ属
corallinae (MARTENS) FALKENBERG in ENGLER et PRANTL にくさえだ

[*Microcladia corallinae*]
dentata (OKAMURA) ITONO　こすじさえだ
[*Microcladia dentata*]
elegans (OKAMURA) ITONO　さえだ
[*Microcladia elegans*]
pygmaea ITONO
Lejolisea BORNET, 1859　レジョリシア属
pacifica ITONO
Neoptilota KYLIN, 1956　かたわべにひば属
asplenioides (ESPER) KYLIN　かたわべにひば
[*Ptilota asplenioides*]
Platythamnion J. AGARDH, 1892　よつがさね属
horridum TOKIDA et INABA　おにのよつばぐさ
intermedium TOKIDA　ひめよつばぐさ
polyspora ITONO
yezoense INAGAKI　よつがさね（よつばぐさ）
[*Antithamnion plumula* sensu OKAMURA]
Pleonosporium NÄGELI, 1862 nom. cons.　くすだま属 (102)
caribaeum (BØRGESEN) NORRIS　なんかいくだこぎぬ
[*Mesothamnion caribaeum*]
dichotomum NODA　ひめくすだま
elongatum NODA　ほそえだくすだま
japonicum ITONO
[*Compsothamniella japonica*]
kobayashii OKAMURA　くすだま
mageshimense (ITONO) NORRIS
[*Compsothamniella mageshimensis*]
mazeense NODA　まぜくすだま
polymorphum ITONO　もつれくすだま
[*Mesothamnion polymorphum*]
pusillum YAMADA　ちゃぼくすだま
segawae YOSHIDA　はねくすだま
[*pinnatum* OKAMURA et SEGAWA in SEGAWA]
tohyamanum TOKIDA et INABA　とうやまくすだま
venustissimum (MONTAGNE) DE TONI　こばんくすだま
yagii (YAMADA) NORRIS　くだこぎぬ
[*Mesothamnion yagii*]
Plumariella OKAMURA, 1930　いとしのぶ属
* *minima* KAJIMURA (103)
yoshikawae OKAMURA　いとしのぶ
Psilothallia SCHMITZ in ENGLER et PRANTL, 1897　べにひば属
dentata (OKAMURA) KYLIN　べにひば
[*Ptilota dentata*]

Ptilocladia SONDER, 1845　プティロクラディア属
japonica ITONO
Ptilota C. AGARDH, 1817 nom. cons.　くしべにひば属 (104)
filicina J. AGARDH　くしべにひば
[*californica* sensu OKAMURA　かしわばべにひば]
[*pectinata* auct. japon.]
[*serrata* auct. japon.]
* *phacelocarpoides* A. ZINOVA　こばのくしべにひば
[*pectinata* f. *litoralis* auct. japon.]
Ptilothamnion THURET in LE JOLIS, 1863　いとひびだま属
cladophorae (YAMADA et TANAKA) G. FELDMANN　いとひびだま
[*Spermothamnion cladophorae*]
pusillum (OKAMURA et SEGAWA in SEGAWA) ITONO
[*Spermothamnion pusillum*]
Reinboldiella DE TONI, 1895　ちりもみじ属
filamentosa ITONO
robusta ITONO
schmitziana (REINBOLD) DE TONI　ちりもみじ
[*Carpoblepharis schmitziana*]
Rhodocallis KÜTZING, 1847　べにひばだまし属
elegans KÜTZING　べにひばだまし
Scagelia WOLLASTON, 1972　からふとよつがさね属
pylaisaei (MONTAGNE) WYNNE　からふとよつがさね (105)
[*corallina*]
[*Antithamnion corallina*]
Seirospora HARVEY, 1846　べにいそぶどう属
orientalis KRAFT　べにいそぶどう (106)
[*occidentalis* sensu ITONO]
Spermothamnion ARESCHOUG, 1847　ひびだま属
echigoensis NODA　えちごひびだま
endophytica OKAMURA　かくれひびだま
Spyridia HARVEY in HOOKER, 1833　うぶげぐさ属
aculeata (C. AGARDH ex DECAISNE) KÜTZING　とげうぶげぐさ
elongata OKAMURA　ながうぶげぐさ
filamentosa (WULFEN) HARVEY　うぶげぐさ
tenuis NODA　ほそうぶげぐさ
Tanakaella ITONO, 1977　タナカエラ属
japonica ITONO
Tiffaniella DOTY et MEÑEZ, 1960　ティファニエラ属
apiculata ITONO

codicola (YAMADA et TANAKA) DOTY et MENEZ みるひびだま
[*Spermothamnion codicola*]
suyehiroi (OKAMURA) KANEKO すえひろひびだま
[*Spermothamnion suyehiroi*]
tamamiru (SEGAWA) GORDON たまみるひびだま
[*Spermothamnion tamamiru*]
Tokidaea YOSHIDA, 1974 べにはねも属
corticata (TOKIDA) YOSHIDA べにはねも
[*Antithamnion corticatum*]
Wrangelia C. AGARDH, 1828 らんげりあ属
minor NODA in NODA et KITAMI ひならんげりあ
penicillata (C. AGARDH) C. AGARDH おおらんげりあ
tagoi (OKAMURA) KAMURA et SEGAWA in SEGAWA たごのり
tanegana HARVEY (107)
tayloriana TSENG らんげりあ
[*argus* sensu YENDO]
[*japonica*]
tenuis NODA ほそいとらんげりあ

Dasyaceae KÜTZING, 1843 だじあ科
Dasya C. AGARDH, 1824 nom. cons. だじあ属
collabens HOOKER et HARVEY
cylindrica NODA つつがただじあ
echigoensis NODA えちごだじあ
elongata NODA ながみだじあ
minor NODA in NODA et KITAMI ひめだじあ
scoparia HARVEY ex J. AGARDH もさだじあ
sessilis YAMADA えなしだじあ
villosa HARVEY けぶかだじあ
Dictyurus BORY in BÉLANGER et BORY, 1834 あみごろも属
purpurascens BORY あみごろも
Heterosiphonia MONTAGNE, 1842 nom. cons. しまだじあ属
japonica YENDO いそはぎ (108)
pulchra (OKAMURA) FALKENBERG しまだじあ
Rhodoptilum (J. AGARDH) KYLIN, 1956 だじもどき属
plumosum (HARVEY et BAILEY) KYLIN だじもどき
Sympodothamnion ITONO, 1977 なんかいさえだ属
leptophyllum (TANAKA) ITONO なんかいさえだ

Delesseriaceae BORY, 1828 このはのり科
Acrosorium ZANARDINI ex KÜTZING, 1869 はいうすばのり属
flabellatum YAMADA やれうすばのり
okamurae NODA in NODA et KITAMI とがりうすばのり
polyneurum OKAMURA すじうすばのり
venulosum (ZANARDINI) KYLIN かぎうすばのり (109)
[*uncinatum*]
yendoi YAMADA はいうすばのり
Apoglossum J. AGARDH, 1898 ひだとりぎぬ属
minimum YAMADA ひだとりぎぬ
Asterocolax J. et G. FELDMANN, 1951 アステロコラックス属
denticulata (TOKIDA) J. et G. FELDMANN ぽりこりね
[*Polycoryne denticulata*]
Branchioglossum KYLIN, 1924 ひげむらさき属
ciliatum OKAMURA ひげむらさき
nanum INAGAKI ひめむらさき
Caloglossa J. AGARDH, 1876 あやぎぬ属
adnata (ZANARDINI) DE TONI ひろはあやぎぬ
bombayensis BØRGESEN
leprieurii (MONTAGNE) J. AGARDH あやぎぬ (110)
ogasawaraensis OKAMURA ほそあやぎぬ
Congregatocarpus MIKAMI, 1971 このはのり属
pacificus (YAMADA) MIKAMI このはのり
[*Laingia pacifica*]
Cottoniella BØRGESEN, 1919 とげこのはのり属
* *amamiensis* ITONO とげこのはのり (111)
Cryptopleura KÜTZING, 1843 nom. cons. かくれすじ属
hayamensis YAMADA ほそばのかくれすじ
membranacea YAMADA かくれすじ
Delesseria LAMOUROUX, 1813 nom. cons. ぬめはのり属
serrulata HARVEY ぬめはのり
[*violacea*]
Erythroglossum J. AGARDH, 1898 ひめうすべに属
minimum OKAMURA ひめうすべに
pinnatum OKAMURA たちうすべに
Hymenena GREVILLE, 1830 うすばのりもどき属
tenuis YAMADA うすばのりもどき
Hypoglossum KÜTZING, 1843 べにはのり属 (112)
barbatum OKAMURA ひげべにはのり
geminatum OKAMURA べにはのり
minimum YAMADA ひめべにはのり
nipponicum YAMADA ほそながべにはのり

sagamianum YAMADA すじべにはのり
serratifolium OKAMURA のこぎりばべにはのり
Kurogia YOSHIDA, 1979 いかだこのは属
pulchra YOSHIDA いかだこのは
Marionella WAGNER, 1954 はぶたえのり属
schmitziana (DE TONI et OKAMURA) YOSHIDA はぶたえのり
[*Hemineura schmitziana*]
Martensia HERING, 1841 nom. cons. あやにしき属
denticulata HARVEY あやにしき
flabelliformis HARVEY ex J. AGARDH えつきあやにしき
Membranoptera STACKHOUSE, 1809 ほそべにやばねぐさ属
* *spinulosa* (RUPRECHT) KUNTZE ひめべにやばねぐさ (113)
Myriogramme (J. AGARDH) KYLIN, 1924 すじぎぬ属
ciliata YAMADA ねだしすじぎぬ
polyneura OKAMURA すじぎぬ
variegata YAMADA ふいりぎぬ
Neoholmesia MIKAMI, 1972 すずしろのり属
japonica (OKAMURA) MIKAMI すずしろのり
[*Holmesia japonica*]
Neohypophyllum WYNNE, 1983 ながこのはのり属
middendorfii (RUPRECHT) WYNNE ながこのはのり
[*Hypophyllum middendorfii*]
Nitophyllum GREVILLE, 1830 nom. cons. うすばのり属
stellato-corticatum OKAMURA ほしがたうすばのり
yezoense (YAMADA et TOKIDA in YAMADA) MIKAMI あつばすじぎぬ
[*Hideophyllum yezoense*]
[*Myriogramme yezoense*]
Phycodrys KÜTZING, 1843 かしわばこのはのり属
fimbriata (DE LA PYLAIE ex J. AGARDH) KYLIN かしわばこのはのり
radicosa (OKAMURA) YAMADA et INAGAKI in YAMADA ひめこのはのり
rubens (LINNAEUS) BATTERS かしわばこのはもどき
Platysiphonia BØRGESEN, 1931 ひげうすば属
clevelandii (FARLOW) PAPENFUSS ひげうすば
* *parva* SILVA et CLEARY なんかいひげうすば (114)
Pollexfenia HARVEY, 1844 ぐんばいこのは属
* *japonica* YOSHIDA et MIKAMI ぐんばいこのは (115)
Polyneura (J. AGARDH) KYLIN, 1924 nom. cons. はすじぎぬ属
japonica (YAMADA) MIKAMI はすじぎぬ
[*Nienburgia japonica*]
Schizoseris KYLIN, 1924 べにやはず属
minima KANEKO et MASAKI えぞひめべにやはず
subdichotoma (SEGAWA) YAMADA ひめべにやはず
Sorella HOLLENBERG, 1943 うすべに属
pulchra (YAMADA) YOSHIDA et MIKAMI くしのはうすべに
[*Erythroglossum pulchrum*]
repens (OKAMURA) HOLLENBERG うすべに
[*Erythroglossum repens*]
Taenioma J. AGARDH, 1863 ひめづた属
nanum (KÜTZING) PAPENFUSS なんかいひめずた (116)
[*macrourum*]
perpusillum (J. AGARDH) J. AGARDH ひめづた
Tokidadendron WYNNE, 1970 らいのすけこのは属
kurilensis (RUPRECHT) PERESTENKO らいのすけこのは (117)
[*bullata*]
[*Pseudophycodrys rainoskei*]
Vanvoorstia HARVEY, 1854 からごろも属
coccinea HARVEY ex J. AGARDH からごろも
[*spectabilis* sensu OKAMURA]
Yamadaphycus MIKAMI, 1973 このはのりもどき属 (118)
carnosus MIKAMI このはのりもどき
[*Okamurina carnosa*]
Zellera MARTENS, 1866 べにはうちわ属
* *tawallina* MARTENS べにはうちわ (119)

Rhodomelaceae J. E. ARESCHOUG, 1847 ふじまつも科
Acanthophora LAMOUROUX, 1813 とげのり属
aokii OKAMURA ひめとげのり
muscoides (LINNAEUS) BORY ことげのり
spicifera (VAHL) BØRGESEN とげのり
[*orientalis*]
Acrocystis ZANARDINI, 1872 つくしほうずき属
nana ZANARDINI つくしほうずき
Amansia LAMOUROUX, 1809 きくひおどし属 (120)
glomerata C. AGARDH きくひおどし
mitsuii SEGAWA うすばひおどし
Ardissonula G. DE TONI f., 1936 ひよくそう属

regularis (OKAMURA) G. DE TONI f. ひよくそう
[*Isoptera regularis*]
Benzaitenia YENDO, 1913 べんてんも属
yenoshimensis YENDO べんてんも
Bostrychia MONTAGNE in RAMON DE LA SAGRA, 1842 nom. cons. こけもどき属
binderi HARVEY ひがしこけもどき
flagellifera POST ふさこけもどき
hamana-tokidae POST にせたにこけもどき
moritziana (SONDER in KÜTZING) J. AGARDH えだねこけもどき
* *pinnata* J. TANAKA et CHIHARA はねこけもどき (121)
[*calliptera* sensu ITONO やえやまこけもどき]
radicans (MONTAGNE) MONTAGNE in KÜTZING ひめこけもどき
simpliciuscula HARVEY ex J. AGARDH たにこけもどき
[*andoi*]
[*tenuis* f. *simpliciuscula*]
tenella (LAMOUROUX) J. AGARDH こけもどき
Chondria C. AGARDH, 1817 nom. cons. やなぎのり属 (122)
armata (KÜTZING) OKAMURA はなやなぎ
crassicaulis HARVEY ゆな
dasyphylla (WOODWARD) C. AGARDH やなぎのり
expansa OKAMURA もさやなぎ
intertexta SILVA もつれゆな
[*intricata* OKAMURA]
lancifolia OKAMURA ささばやなぎのり
mageshimensis TANAKA et K. NOZAWA in TANAKA しんかいゆな
minutula NODA ひめやなぎのり
polyrhiza COLLINS et HERVEY
repens BØRGESEN ひめやなぎのり
ryukyuensis YAMADA べにやなぎのり
stolonifera OKAMURA つるやなぎのり
tenuissima (GOODENOUGH et WOODWARD) C. AGARDH ほそやなぎのり
Dasyclonium J. AGARDH, 1894 くしのは属
flaccidum (HARVEY) KYLIN くしのは
[*Euzoniella flaccida*]
ocellatum (YENDO) SCAGEL くしのはもどき
[*Euzoniella ocellata*]
Digenea C. AGARDH, 1822 まくり属
simplex (WULFEN) C. AGARDH まくり
Ditria HOLLENBERG, 1967 しのぶぐさ属
zonaricola (OKAMURA) T. et M. YOSHIDA しのぶぐさ
[*Herpopteros zonaricola*]
Enantiocladia FALKENBERG in ENGLER et PRANTL, 1897 あいそめぐさ属
okamurae YAMADA あいそめぐさ
Enelittosiphonia SEGI, 1949 まきいとぐさ属
hakodatensis (YENDO) SEGI まきいとぐさ
[*Polysiphonia hakodatensis*]
Exophyllum WEBER VAN BOSSE, 1910 あつばこうもりのり属
wentii WEBER VAN BOSSE あつばこうもりのり
Herposiphonia NÄGELI, 1846 ひめごけ属
caespitosa TSENG いわひめごけ
fissidentoides (HOLMES) OKAMURA ひめごけ
insidiosa (GREVILLE) FALKENBERG かぎひめごけ
parca SETCHELL くものすひめごけ (123)
[*tenella* auct. japon.]
[*terminalis*]
subdisticha OKAMURA くろひめごけ
Janczewskia SOLMS-LAUBACH, 1877 そぞまくら属
morimotoi TOKIDA もりもとそぞまくら
[*tokidae*]
Laurencia LAMOUROUX, 1813 nom. cons. そぞ属
brongniartii J. AGARDH そぞのはな
[*grevilleana*]
capituliformis YAMADA まるそぞ
* *carolinensis* SAITO (124)
cartilaginea YAMADA かたそぞ
ceylanica J. AGARDH せいろんそぞ
composita YAMADA きくそぞ
filiformis (C. AGARDH) MONTAGNE なんてんそぞ
[*heteroclada*]
hamata YAMADA かぎそぞ
intermedia YAMADA くろそぞ
intricata LAMOUROUX もつれそぞ
majuscula (HARVEY) LUCAS あかそぞ
[*obtusa* var. *majuscula*]
mariannensis YAMADA ふくれそぞ
nidifica J. AGARDH みなみそぞ
nipponica YAMADA うらそぞ
[*glandulifera* sensu YAMADA]
obtusa (HUDSON) LAMOUROUX まぎれそぞ
okamurae YAMADA みつでそぞ (125)
[*japonica* おもてそぞ]
papillosa (C. AGARDH) GREVILLE ぱぴらそぞ

pinnata Yamada はねそぞ
surculigera Tseng いわかがり
* *tropica* Yamada なんかいそぞ (124)
undulata Yamada こぶそぞ
venusta Yamada ひめそぞ
yamadana Howe しまそぞ
[*amabilis*]
yendoi Yamada きたそぞ
Lenormandiopsis Papenfuss, 1967 すじなしぐさ属
lorenzii (Weber van Bosse) Papenfuss すじなしぐさ
[*Aneuria lorenzii*]
Leveillea Decaisne, 1839 じゃばらのり属
jungermannioides (Martens et Hering) Harvey じゃばらのり
Lophocladia Schmitz, 1893 よれみぐさ属
japonica Yamada よれみぐさ
lallemandii (Montagne) Schmitz
minima Itono なんかいよれみぐさ
Lophosiphonia Falkenberg in Engler et Prantl, 1897 はいいとぐさ属
hayashii Segawa はいいとぐさ
Melanamansia Norris, 1988 ひおどしぐさ属 (120)
japonica (Holmes) Norris ひおどしぐさ
[*Amansia japonica*]
scalpellata (Tanaka) Norris すじなしひおどし
[*Amansia scalpellata*]
Murrayella Schmitz, 1893 ながみぐさ属
periclados (C. Agardh) Schmitz ながみぐさ
[*squarrosa*]
Neorhodomela Masuda, 1982 ふじまつも属
aculeata (Perestenko) Masuda ふじまつも
[*Rhodomela larix* auct. japon.]
munita (Perestenko) Masuda いとふじまつ
[*Rhodomela subfusca* auct. japon.]
oregona (Doty) Masuda あっけしふじまつも
Neurymenia J. Agardh, 1863 いそばしょう属
fraxinifolia (Mertens ex Turner) J. Agardh いそばしょう
nigricans Tanaka et Itono くろいそばしょう
Odonthalia Lyngbye, 1819 nom. cons. のこぎりひば属
annae Perestenko ありゅうしゃんのこぎりひば
[*aleutica* auct. japon.]
corymbifera (Gmelin) Greville はけさきのこぎりひば
kawabatae Masuda しこたんのこぎりひば
macrocarpa Masuda おおのこぎりひば
yamadae Masuda あっけしのこぎりひば
[*kamtschatica* auct. japon.]
Placophora J. Agardh, 1863 はいこざね属
binderi (J. Agardh) J. Agardh はいこざね
japonica Tanaka かばいろはいうすば
Polysiphonia Greville, 1823 nom. cons. いとぐさ属 (126)
abscissa Hooker et Harvey さんぼういとぐさ
bicornis Ohta
brodiaei (Dillwyn) Sprengel おおいとぐさ
crassa Okamura ふといとぐさ
cystophyllicola Noda ひふみいとぐさ
decumbens Segi りぼんいとぐさ
echigoensis Noda えちごいとぐさ
elongata (Hudson) Sprengel
f. *schuebelerii* (Foslie) Rosenvinge
ferulacea Suhr ex J. Agardh ぼういとぐさ
fragilis Suringar くろいとぐさ
[*forcipata* sensu Segi]
harlandii Harvey たいわんいとぐさ
japonica Harvey きぶりいとぐさ (127)
[*akkeshiensis* あっけしいとぐさ]
[*grateloupeoides* えちごひめいとぐさ]
[*nipponica* にっぽんいとぐさ]
[*novae-angliae* sensu Segi ながつぼいとぐさ]
[*spinosa* sensu Segi とげいとぐさ]
latiovalis Noda うすむらさきいとぐさ
morrowii Harvey もろいとぐさ
[*senticulosa* sensu Segi]
notoensis Segi のといとぐさ
ohmaensis Ohta おおまいとぐさ
porrecta Segi ながいとぐさ
richardsonii Hooker もつれいとぐさ
sadoensis Noda さどいとぐさ
savatieri Hariot ひめいとぐさ
[*aggregata*]
senticulosa Harvey しょうじょうけのり (128)
[*urceolata* auct. japon.]
siretokensis Yamada in Yamada et Tanaka きたいとぐさ
sphaerocarpa Børgesen ひないとぐさ
[*pulvinata* sensu Segi]
tapinocarpa Suringar けいとぐさ

teradomariensis NODA えちごひめいとぐさ
tokidae SEGI うすいとぐさ
tongatensis HARVEY ex KÜTZING べにぼっす
upolensis (GRUNOW) HOLLENBERG
yendoi SEGI えんどういとぐさ (129)
[*codiicola* sensu SEGI ばらいとぐさ]
[*obsoleta* ほそいとぐさ]
[*scopulorum* sensu SEGI おわりいとぐさ]
[*subtilissima* sensu SEGI きぬこまち]
yonakuniensis SEGI よなくにいとぐさ

Pterosiphonia FALKENBERG in ENGLER et PRANTL, 1897 はねぐさ属
arctica (J. AGARDH) SETCHELL et GARDNER いなぼぐさ
bipinnata (POSTELS et RUPRECHT) FALKENBERG いとやなぎ
fibrillosa OKAMURA けはねぐさ
pennata (C. AGARDH) FALKENBERG はねぐさ

Rhodolachne WYNNE, 1970 ロドラクネ属
* *radicosa* ITONO (130)

Rhodomela C. AGARDH, 1822 nom. cons. せいようふじまつも属
lycopodioides (LINNAEUS) C. AGARDH
f. *tenuissima* (RUPRECHT) KJELLMAN みやびふじまつも
sachalinensis MASUDA からふとふじまつも
[*macracantha* sensu TOKIDA]
teres (PERESTENKO) MASUDA ほそばふじまつも
[*gracilis* YAMADA et NAKAMURA]

Spirocladia BØRGESEN, 1935 ひげよれみぐさ属
loochooensis (YENDO) YOSHIDA ひげよれみぐさ (131)
[*Wrightiella loochooensis* らいちえら]

Stictosiphonia HOOKER et HARVEY, 1847 スチクトシフォニア属 (132)
hookeri (HARVEY) HARVEY in HOOKER はまなこけもどき
[*Bostrychia dichotoma*]
[*Bostrychia mixta*]
kelanensis (GRUNOW ex POST) KING et PUTTOCK ふたまたこけもどき
[*Bostrychia kelanensis*]
tangatensis (POST) KING et PUTTOCK
[*Bostrychia tangatensis*]

Symphyocladia FALKENBERG in ENGLER et PRANTL, 1897 こざねも属
latiuscula (HARVEY) YAMADA いそむらさき
[*gracilis*]
linearis (OKAMURA) FALKENBERG ほそこざねも
marchantioides (HARVEY in HOOKER) FALKENBERG in ENGLER et PRANTL こざねも
pennata OKAMURA ひめこざね

Tolypiocladia SCHMITZ in ENGLER et PRANTL, 1897 いとくずぐさ属
glomerulata (C. AGARDH) SCHMITZ in ENGLER et PRANTL いとくずぐさ
[*Roschera glomerulata*]

Vidalia LAMOUROUX ex J. AGARDH, 1863 nom. cons. かえりなみ属
obtusiloba (MERTENS ex C. AGARDH) J. AGARDH かえりなみ

紅藻に関するノート

(1) *Asterocytis* 属は *Chroodactylon* 属の異名とされているので，命名上で検討する必要がある。NODA (1975) により f. *simplex* が記載されている。
(2) DREW (1956) は命名上 *Stylonema* の属名が正しいとした。
(3) チノリモ科の日本産種については原・加藤・千原 (1985) の報告による。
(4) 異名は HEEREBOUT (1968) による。
(5) *P. bulbopes* フクロタサ，*P. tasa* タサは分布が北千島に限られるので除外した。
(6) f. *crassa* アツバベニタサ，f. *elliptica* マルバベニタサ，f. *lanceolata* ナガバベニタサが区別される (KAWABATA 1941, NAGAI 1941)。
(7) 有性生殖をしない f. *sanrikuensis* ニセコスジノリが岩手県から知られている（黒木 1961)。
(8) f. *lanceolata* ナガバアナアマノリが区別された (TANAKA 1952)。
(9) f. *latifolia* ヒロハマルバアマノリが区別された (TANAKA 1952)。
(10) f. *kjellmanii* と var. *tamatsuensis* オオバアサクサノリが知られている（岡村 1936, 三浦 1971, 1972)。
(11) f. *coreana* と f. *narawaensis* ナラワスサビノリが知られている（岡村 1936, 三浦 1971, 1972)。
(12) 科名は Rhodochortaceae のほうが早く発表された。従来のものを使用しておく。この科にいくつの属を認めるか意見の分かれるところである。
(13) *Acrochaetium, Rhodochorton* については *Audouinella* への組合せが行われていないものもあり，命名上，

分類学上の問題点があるので，そのままとした。

(14) Kajimura (1987b) が隠岐から報告した。

(15) *Auduinella* の綴りが Bory によって発表されたが，習慣的に用いられている *Audouinella* の綴りが保留された。

(16) Lee (1980) が北海道から報告した。

(17) Yamada (1944)。

(18) 独立の目 Bonnemaisoniales とする意見もある。

(19) 四分胞子体は *Falkenbergia rufolanosa* である。

(20) 四分胞子体は *Trailliella intricata* である。

(21) 日本産の種はオーストラリアのものと生活史の様式が異なり，この名が用いられる。

(22) *Delisea* 属と異なるという Bonin and Hawks (1988) の意見に従う。

(23) Yoshizaki (1987) により沖縄県から記載された。

(24) 日本産のガラガラ属に多数の種が記録されている。これらはもっと少数の種に纏められるであろう。Papenfuss *et al.* (1982) などによれば

G. marginata＝*clavigera, ventricosa, veprecula*

G. oblongata＝*cylindrica, fastigiata, pilifera*

G. rugosa＝*cuculigera, elongata, glabriuscula*

とすべきであるという。生活史の研究を含めて今後の研究に待つ。

(25) 異名は Itono (1985) による。

(26) 異名は Itono (1977) による。

(27) Kajimura (1988) により隠岐から記載された。

(28) *Pseudogloiophloea* 属を認めない Huisman (1985) の意見に従う。

(29) ヨーロッパではこの種は *N. helminthoides* と同種とされている。

(30) Segi (1957) が報告した *G. corneum* var. *pulchellum* リュウキュウブトは命名上の問題があるのでここでは収録しなかった。

(31) マクサの学名について Santelices (1988), Norris (1990) により疑問が出された。横浜で採集された標本に基づく *G. elegans* の名前を採用するのが妥当であろう。種内分類群については検討を要する。

(32) Akatsuka (1986) は *Onikusa* 属を記載した。この属の独立性に疑問が持たれている (Santelices, 1988)。

(33) var. *conchicola* ケスジハイテングサ，f. *foliacea* ヒロハハイテングサが区別された（岡村 1936)。

(34) Norris (1987) により *Beckerella* は *Ptilophora* に含められた。

(35) 松本・吉田 (1990) により根室から報告された。

(36) 目のレベルで Corallinales とすべきであるという意見がある (Silva and Johansen, 1986)。

(37) Srimanobhas (1987) が南日本産として報告した。

(38) Srimanobhas and Masaki (1987) が鹿児島県から記載した。

(39) 宮田ほか (1990) は *Alatocladia* をこの属の亜属とした。

(40) この属の種については Srimanobhas *et al.* (1990) による。

(41) Baba *et al.* (1988) によれば，*C. confusa* は *Corallina* X (＝*squamata* auct. japon.) の夏型であるから，ミヤヒバの学名はこのようになるであろう。

(42) f. *filiformis*, f. *intermedia*, f. *sororia* が区別されている（岡村 1936)。異名については Baba *et al.* (1988) による。

(43) Baba (1987) により南日本から報告された。

(44) *Lithothamnium* Philippi に対して *Lithothamnion* Heydrich が保留された。

(45) 馬場・正置 (1985) が南西諸島から報告した。

(46) Chamberlain (1983) の意見に従い *Pneophyllum* の名前を用いる。

(47) Woelkerling (1985) の意見に従う。

(48) Woelkerling *et al.* (1985) の意見による。しかし Campbell and Woelkerling (1990) によれば *Titanoderma* は *Lithophyllum* の異名であるという。命名の上からも検討を要する。

(49) 馬場・秋岡・正置 (1990) による。

(50) 吉崎・千原 (1974) により *Acrosymphyton* sp. が日本に産することが報告された。

(51) *Thuretellopsis japonica* Segawa et Ichiki ミスミヒビロウドは多分この種の異名であろう。

(52) 糸野 (1971) が報告したエツキヒビロウドは Kraft (1986a) によりこの種であるとされた。

(53) Lindstrom (1988) により生活史の違いなどから独立の属とされた。

(54) *Endocladia yasudae* Yendo (岡村 1936) については実体が明かでない。

(55) f. *coliformis*, f. *intricata* が区別された（岡村 1936)。

(56) キントキが *Prionitis* 属に移された (Kawaguchi 1989) ので属の名をちゃぼきんとき属とする。

(57) f. *minuta* が区別された（岡村 1936)。

(58) Kawaguchi (1987) の意見による。

(59) f. *lomentaria*, var. *porracea* ウツロムカデが区別されている（岡村 1936)。

(60) f. *flabellata* が区別された（岡村 1936)。

(61) KAWAGUCHI and YOSHIDA (1986) によりこの科に所属することが示された。

(62) アカハダ *Pachymenia carnosa* sensu YENDO は KAWAGUCHI (1987) によればタンバノリと区別できない。

(63) キントキがこの属のものとされたので，属の名をキントキ属とする。種については KAWAGUCHI (1989) による。

(64) 目のレベルで Hildenbrandiales とする意見がある (PUESCHEL and COLE 1982)。

(65) 綴りにいくつかの異なったものがある。ここに用いたものが正しい。科名と属名の綴りが違うので注意を要する。

(66) YENDO (1915) が報じた *C. laciniata* は標本からみて少なくとも2種を混合しているので，ここには収録しなかった。

(67) 学名は MAGGS, MCLACHLAN and SAUNDERS (1989) の意見による。基物から遊離して生活しているイタニグサ *A. tobuchiensis* は生態型とする考えを取り入れた。

(68) 琉球から記載（岡村 1936）されてから記録がなく，実体不明である。

(69) f. *latus* ヒロハノコトジが区別された（岡村 1936)。

(70) f. *flabellatus* ウチワツノマタが区別された (MIKAMI 1965)。

(71) これまで *Chondrus crispus* と呼ばれていた種にはこの学名を用いるべきであるとの結論が出された (BRODIE, GUIRY and MASUDA 1990)。

(72) f. *aequalis* ヤセツノマタ，f. *crispoides* トチャカダマシ，f. *parvus* ヒメツノマタが記載された (MIKAMI 1965)。

(73) f. *armatus* トゲツノマタ，f. *ciliatus*, f. *flabellatus* ウチワヒラコトジ，f. *longicornis* ハサミヒラコトジが記載された (MIKAMI 1965, TOKIDA 1954)。

(74) f. *fimbriatus* フサツノマタ，f. *subdichotomus* エダツノマタが区別された (MIKAMI 1965)。

(75) f. *oblongo-ovatum* トカチギンナンが区別された (MIKAMI 1965)。

(76) f. *divergens* エダウチギンナンが区別された (MIKAMI 1965)。

(77) FREDERICQ and HOMMERSAND (1989) は Gracilariales を提唱した。

(78) YAMAMOTO (1986) によりフシクレノリの寄生藻として沖之永良部島から記載された。

(79) シンカイカバノリ *Gracilaria sublittoralis* YAMADA et SEGAWA, nomen nudum (高嶺・山田 1950) については取扱を検討中。

(80) 大西洋の *G. verrucosa* は太平洋には分布しないということが認められるようになった。アジアのものについては張・夏 (1985) の意見に従っておく。

(81) 異名については XIA (1986) による。

(82) f. *gracilis* コサイダイバラが区別されている (TANAKA 1941)。

(83) 元の綴り *Nemostoma* に対して慣用の *Nemastoma* の綴りが保留された。

(84) KAJIMURA (1987a) により隠岐島から記載された。

(85) 四分胞子体は *Petrocelis* 属とされていたものである。

(86) オキツノリ属の日本産の種については MASUDA (1987) が再検討を行った。

(87) 学名については検討中である。

(88) TANAKA and ITONO (1972) により沖縄県から報告された。

(89) f. *uncinatum* が区別された（岡村 1936)。

(90) ナミノハナ属の学名として *Portiera* を用いるのが正しいと SILVA, MEÑEZ and MOE (1987) が論じた。

(91) var. *elongata* ホソミアナグサが区別された (TANAKA 1960)。

(92) アジアに産する種類は南半球の *S. robusta*, *S. mollis* とは異なることが明かとなり，それぞれ YOSHIDA (1989), XIA and ZHANG (1984) により変更された。

(93) KAJIMURA (1987) が隠岐島から記載した。

(94) 異名は CORMACI and FURNARI (1988) による。

(95) 異名は LINDSTROM and GABRIELSON (1989) による。

(96) f. *australis*, f. *borealis*, f. *cymosa*, f. *elongata* が区別されている (ITONO 1972, NAKAMURA 1950)。

(97) f. *hamata* が区別される (NAKAMURA 1950)。

(98) *Reinboldiella* 属に移されるものであろう。

(99) var. *robustum* が区別されている (ITONO 1977a)。

(100) 異名は WOMERSLEY (1978) による。

(101) ITONO (1977a) が与論島から *Centroceras minutum* として報告したものは ARDRÉ (1987) により YAMADA (1944a) の種と異なり，新種として記載された。

(102) NORRIS (1985) は *Mesothamnion* BØRGESEN と *Compsothamniella* ITONO を *Pleonosporium* の異名とした。

(103) KAJIMURA (1986) により隠岐島から記載された。

(104) この属の日本産の種については MASUDA and SASAKI (1990) が研究した。

(105) 異名については WYNNE (1985) による。

(106) ITONO (1971) が奄美大島から報告した種は KRAFT (1988) によれば大西洋のものと異なる。

(107) 記載 (岡村 1936)以後採集記録がなく，実体不明である。

(108) f. *nipponica*, f. *pacifica* が区別される(岡村 1936)。

(109) 異名については WYNNE (1989) による。

(110) var. *hookeri* ササバアヤギヌが区別された (田中 1989)。

(111) ITONO (1972) が奄美大島から記載した。

(112) *H. tortile* ヨレベニハノリ (NODA 1970) については今後の検討に待つ。

(113) 松本・吉田 (1989) が根室から記録した。

(114) ITONO (1972a) が南西諸島から記録した。

(115) YOSHIDA and MIKAMI (1990) が相模湾から記載した。

(116) 異名については ITONO (1972) による。

(117) 異名は PERESTENKO (1983) による。

(118) *Okamurina* ZINOVA の名前が早く発表されたが，命名規約上問題があり，使用できないので，*Yamadaphycus* が正しい名前である。

(119) ITONO (1986) により沖縄県から記録された。

(120) NORRIS (1988) は *Amansia* 属から *Melanamansia* 属を分離した。属の和名もそれに従って変更した。

(121) TANAKA and CHIHARA (1984a) により沖縄県から記載された。異名は田中 (1989) による。

(122) *C. atropurpurea*? とされているものについては *C. decipiens* との関係を調べる必要がある。

(123) 異名は HOLLENBERG (1968) に従った。

(124) 大葉・有賀 (1982) が石垣島から報告した。

(125) 異名は斉藤 (1989) による。

(126) イトグサ属は大きい属で，ここに挙げたもののほか *P. cancellata, P. elongella, P. flabellulata, P. stimpsonii, P. violacea, P. yokoskensis* などの記録がある (岡村 1936)。これらについて今後の研究 に待つ。

(127) 異名については KUDO and MASUDA (1986) と工藤 (1989) による。

(128) 学名については工藤 (1989) による。

(129) 異名については工藤 (1989) に従った。

(130) ITONO (1985) が石垣島から記載した。

(131) ライチエラの所属を変更したのにともなって和名も変えた (YOSHIDA, 1989a).

(132) KING and PUTTOCK (1989) の意見に従って *Bostrychia* 属から分離した。

(133) KAWAGUCHI (1990) が関東から西の太平洋岸，瀬戸内海，九州西岸の材料に基いて記載した。これまで *Halymeniopsis dilatata* と仮称されていたものである。

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（細字の頁数は当該属が異名 synonym として記されている頁，またはノート欄に記されている頁を示す。属名をイタリックで示したものは，synonym としてのみ用いられているもの，あるいはノート欄だけに記されているものである。）

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新 刊 紹 介

福代康夫・高野秀昭・千原光雄・松岡数充編
日本の赤潮生物—写真と解説
内田老鶴圃．407頁（1990）．13,390円

いきなり私事にわたって恐縮であるが，筆者が1978年に国立公害研究所（現国立環境研究所）に赴任して，赤潮発生機構の研究にたずさわることになった時には，赤潮原因種の分類はきわめて混乱した状態であった。例えば，瀬戸内海播磨灘で大規模な赤潮を形成する *Chattonella antiqua, C. marina* 等は *Hornellia* sp. とされ，霞ヶ浦等で水の華を形成する *Microcystis aeruginosa, M. viridis, M. wesenbergii* はすべて *M. aeruginosa* あるいは *M.* sp. として報告されていたものである。このような状態では，赤潮研究の円滑な推進は困難ではないかと思っていたところ，1979年度になって農林水産省と環境庁が事務局となり，大学及び研究機関の学識経験者からなる「赤潮研究会」が分類・機構・予察・防除の4班構成で発足した。分類班をのぞく他の3班は1982年度で解散したが，分類班のみは存続し「赤潮問題研究会・分類部会」として1984年度まで活発な活動を行った。この間，「赤潮マニュアル」（全5巻）及び「赤潮生物シート」（全6巻）を刊行して，国内外の大学・研究機関の赤潮研究に大いに活用され，赤潮研究の発展に対する貢献は著しいものであった。その後「赤潮マニュアル」は「赤潮生物研究指針」（日本水産資源保護協会編，秀和刊）として増補改訂され多くの関連する研究者に大いに活用されている。今回もう一方の「赤潮生物シート」を増補・改訂し，「日本の赤潮生物—写真と解説」として刊行したことは，赤潮研究及び藻類研究にたずさわる多くの研究者にとって，これほど慶ばしいことはない。ここに関係者各位にたいして満腔の敬意を表明したい。

本書は，「赤潮生物シート」では同一綱の種でも各巻に分載されていたものを一連にまとめ，種の解説についても改訂をくわえている。200種類の赤潮生物について掲載し，各綱内訳としては，藍藻8種，クリプト藻2種，渦鞭毛藻70種，珪藻85種，ラフィド藻9種，黄金藻6種，ハプト藻4種，ユーグレナ藻8種，プラシノ藻5種，緑藻1種及び原生動物2種である。各種とも光学顕微鏡，走査型電子顕微鏡あるいは透過型電子顕微鏡の写真が適切にレイアウトされ，その生物全体の大きさや外部形態の特徴が詳細に記述されているだけでなく，内部形態やシスト形成の有無，生活史，生理・生態及び赤潮形成の有無等についても記述されている。解説文を読んで感激することは，分類や形態については，出来る限り最新の知見をいれたいという編者及び執筆者の意気込みが随所に見られることである。例えば，瀬戸内海播磨灘で大規模な赤潮を形成する *Chattonella* 属については，従来の *C. antiqua, C. marina* にくわえ4種類の新種を，論文として準備中にもかかわらず，掲載していることは，*Chattonella* の研究を行っている研究者にとってはこのうえない情報である。ただし，海産赤潮の主要な種はもれることなく掲載されているのに対し，藍藻 *Microcystis wesenbergii, Anabaena affinis, Aphanizomenon flos-aquae, Gloeotrichia echinulata,* 緑藻 *Closterium aciculare* var. *subpronum, Staurastrum dorsidentiferum* var. *ornatum,* 渦鞭毛藻 *Ceratium hirundinella* 等湖沼で赤潮を形成する代表的な種がもれていることから，淡水赤潮についてはまだ不十分という感じが残る。

本書の表紙及び解説はすべて和文，英文の併用となっており，国外の研究者も十分活用できるようになっている。日本に出現したものに限ってはいても，赤潮生物についてこのような形で集大成した例は国外でも皆無であり，国際的に高い評価をうけることは間違いないと思われる。ただし，唯一残念に思うことは，写真の説明に英文がないことである。本書では，写真が極めて重要なものであるにもかかわらず，何故英文の説明をいれなかったのか理解に苦しむ。これにより，表紙，解説文を和文，英文併用とした意味が殆どなくなっているといっても過言でないほど，全く残念なことであり，いまからでも何らかの手段で英文の説明をいれられないだろうかと思う。

（国立環境研究所生物圏環境部　渡辺　信）

—学 会 録 事—

—会 員 移 動—

新 人 会

住 所 変 更

訃　　　報

本会会員　渡部雅之氏は去る1989年7月18日逝去されました。謹んで哀悼の意を表します。　日本藻類学会

本会会員　小出悟郎氏は去る1990年6月30日逝去されました。謹んで哀悼の意を表します。　日本藻類学会

本会会員　新崎輝子女史は去る1990年7月9日逝去されました。謹んで哀悼の意を表します。　日本藻類学会

退　　　会

横田雅之（千葉県）

訂　　　正

本誌第38巻第2号 p.197 の表-1の＊印は，「バックナンバー」だけでなく「団体会員」及び「定期講読」にも付きます。お詫びして訂正いたします。

日本学術会議だより　№18

第15期日本学術会議会員の選出手続き始まる

平成２年８月　日本学術会議広報委員会

日本学術会議では，現在，第15期会員を選出するための手続きが進められています。今回の日本学術会議だよりでは，その手続きの概要に加えて，来年度に開催される共同主催国際会議等について，お知らせいたします。

第15期日本学術会議会員の選出について

日本学術会議では，現在，第15期会員（任期：平成３年７月22日から３年間）を選出するための手続きが進められている。

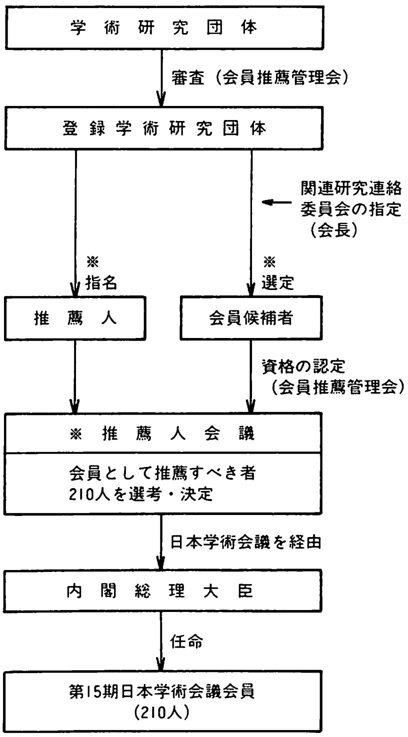
先般，最初の手続きとして，６月末日を締切期限に，各学術研究団体からの登録申請の受付が行われた。今回申請のあった団体数は，942団体であった。

今後引き続き行われる手続きとその日程の概略は次のとおりである。

《平成２年》
- ９月上旬…………登録審査結果の通知
- 〃　…………関連研究連絡委員会（注）についての意見聴取
- 11月30日まで……関連研究連絡委員会の指定
- 12月上旬…………会員の候補者の選定及び推薦人の指名の依頼

《平成３年》
- １月31日まで……会員の候補者の届出の締切り
- ２月20日まで……推薦人（予備者を含む）の届出の締切り
- ３月20日まで……会員の候補者の資格の認定等の通知
- ３月下旬…………推薦人に会議開催等の通知発送
- ４月20日まで……〈候補者関係〉異議の申出に対する決定
- ５月中旬から
  ６月上旬まで…推薦人会議（会員及び補欠の会員として推薦すべき者を決定）
- ６月中旬…………日本学術会議を経由して内閣総理大臣へ推薦
- ７月22日…………第15期日本学術会議会員の任命

《会員選出手続きに関するフローチャート》



※　指定された関連研究連絡委員会により区分された学術研究領域ごとに行われる（下記の（注）を参照）。

（注）　関連研究連絡委員会：学術研究団体がその目的とする学術研究の領域と関連する研究連絡委員会として，届け出た研究連絡委員会。届け出た関連研究連絡委員会が複数あるときは，日本学術会議会長は，登録学術研究団体の意見を聴いて関連研究連絡委員会を指定（限定）する。

登録学術研究団体は，この指定された関連研究連絡委員会により区分された学術研究の領域ごとに，会員の候補者及び推薦人を届け出ることになる。

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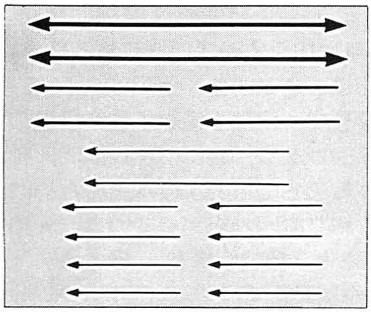

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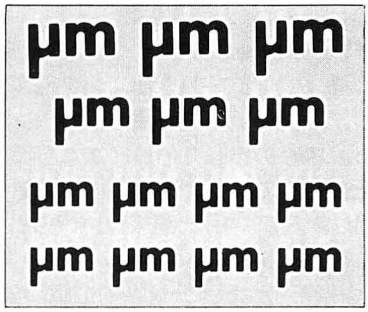

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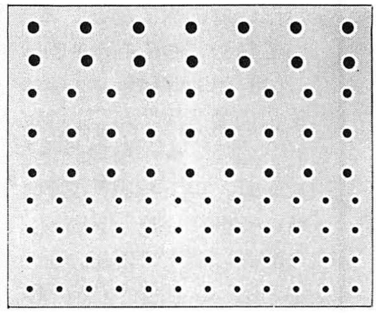

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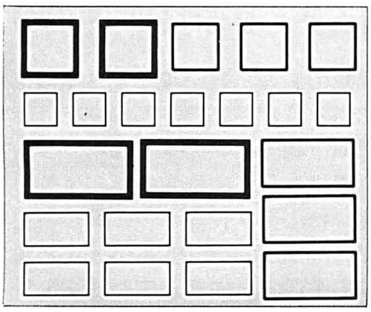

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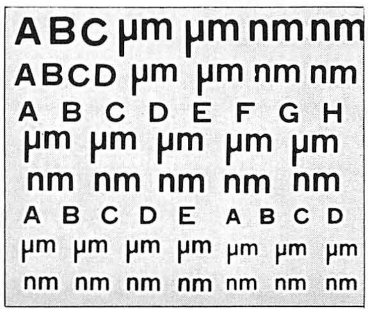

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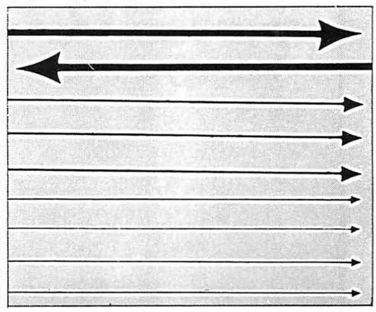

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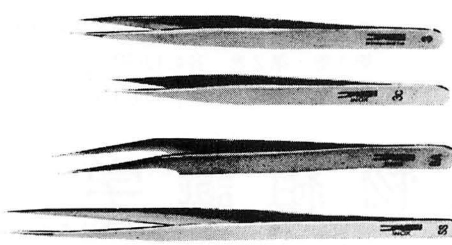

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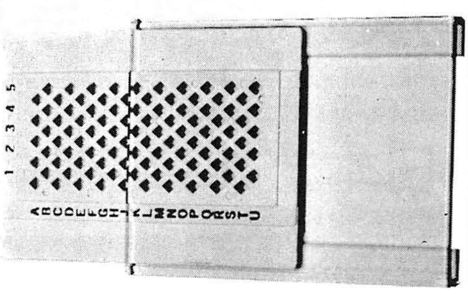

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